SMOKY-SALINE RIVER BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: Smoky Hill River
Water Quality Impairment: Nitrate as Nitrogen

1. INTRODUCTION

Subbasin: Lower Smoky Hill

Counties: Saline (SA) and McPherson (MP)

HUC8: 10260008 **HUC10** (12)**: 03** (02, 03, 04, 05, 06)

Ecoregion: Smoky Hills (27a)

Drainage Area: 205 mi^2

Main Stem Water Quality Limited Segments and Tributaries (designated uses are detailed in **Table 1**):

Main Stem	Tributaries
HUC8 10260008	
Smoky Hill River (13)	Pewee Creek (56; unimpaired)
	Dry Creek (36)

Table 1. Designated uses for main stem and tributary segments in the Smoky Hill River.

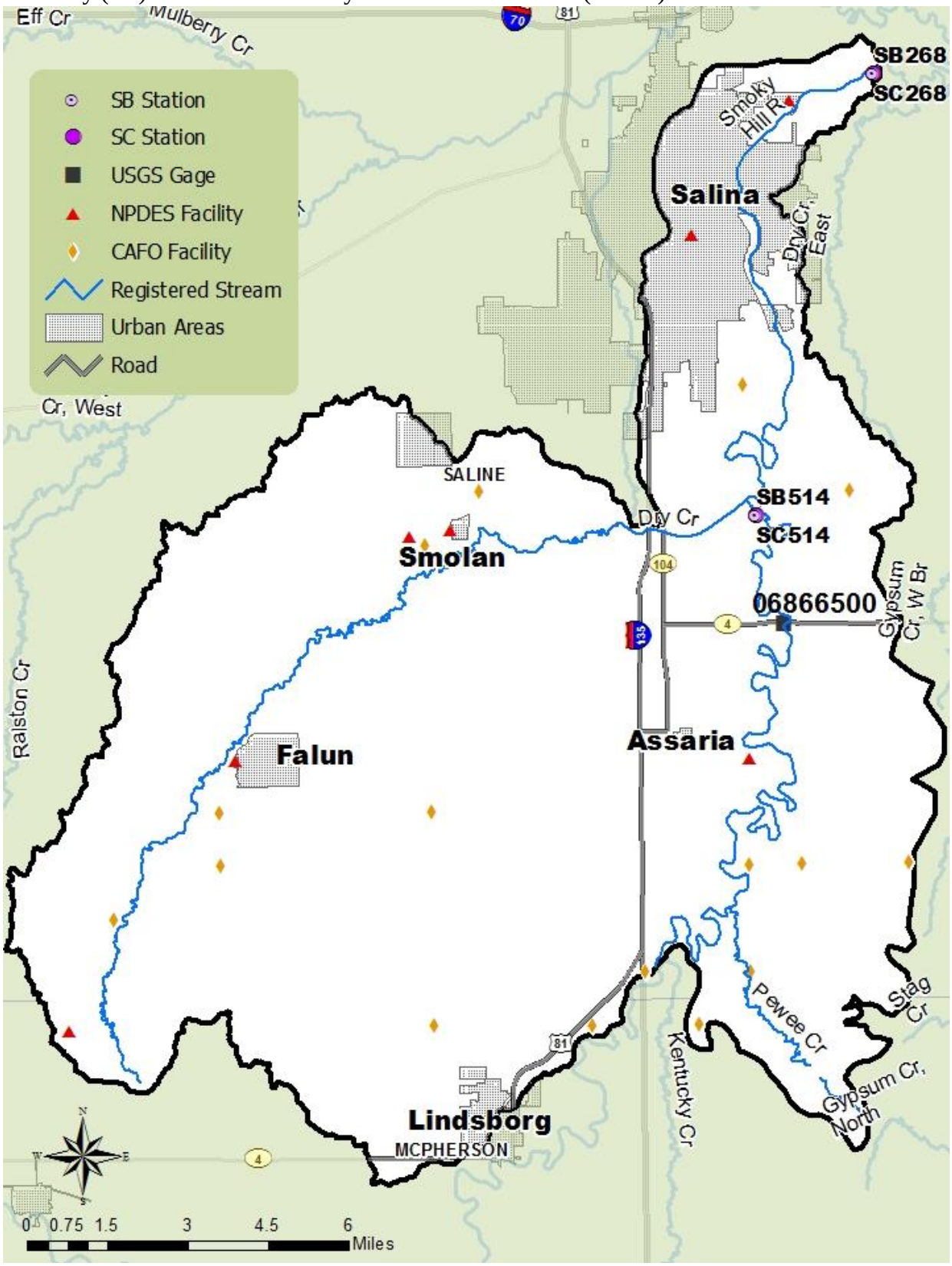
Stream	Segment	Aquatic Life	Contact Recreation	Domestic Supply	Food Procurement	Groundwater Recharge	Industrial	Irrigation	Livestock Watering
HUC8: 10260008									
Smoky Hill R	13	E	B	Y	Y	Y	Y	Y	Y
Pewee Cr	56	E	b	Y	N	Y	Y	Y	Y
Dry Cr	36	E	b	N	N	Y	Y	Y	Y

Definitions: E - expected aquatic life; B - primary contact recreation stream segment; Y - referenced stream segment is assigned the indicated designated use; b - secondary contact recreation stream segment; N - referenced stream segment does not support the indicated designated use

303(d) Listings
Station SC268 (**Figure 1**), Smoky Hill River near Salina.
Nitrate as nitrogen (NO3-N) Impairment, Category 5: 2008, 2010, 2014, 2016, and 2018.
Category 2: 2012.

Impaired Use
Expected Aquatic Life, Contact Recreation, and Domestic Water Supply.

Figure 1. Map of contributing area for Kansas Department of Health and Environment stream chemistry (SC) station in the Smoky Hill River near Salina (SC268).



Water Quality Criteria

Numeric

Nitrate as nitrogen (NO3-N): The domestic water supply criterion is 10 milligrams per liter (mg/L; KAR 28-16-28e(c)(3); KAR 28-16-28e(e), Tables of Numeric Criteria: Table 1a; Kansas Department of Health and Environment, 2017).

2. CURRENT WATER QUALITY CONDITIONS AND DESIRED ENDPOINT

Level of Support for Designated Uses under 2018 303(d)

Nitrate as nitrogen (nitrate-n) levels in the Smoky Hill River near Salina (SC268) occasionally exceed the Kansas Water Quality Standards of 10 mg/L. Excessive nitrate-n is not being controlled and is thus impairing the designated uses of expected aquatic life, contact recreation, and domestic water supply. The ultimate endpoint of this Total Maximum Daily Load (TMDL) will be to achieve the Kansas Water Quality Standards by reducing nitrate-n levels to fully support all designated uses.

Station Location and Period of Record

Stream Chemistry (SC) Monitoring Stations

SC514: Active permanent station on the Smoky Hill River near Mentor, located on County Road Bridge 1.5 miles east of Mentor. Period of record: February 14, 1995 to June 12, 2017.

SC268: Active permanent station on the Smoky Hill River near Salina, located on County Road Bridge 4.0 miles east and 1.5 miles north of Salina. Period of record: February 14, 1995 to June 12, 2017.

Streamflow Gages

06865500: U.S. Geological Survey gage at Smoky Hill River near Langley. Period of record: January 1, 1995 to June 30, 2017. Located below Kanopolis Reservoir.

06866500: U.S. Geological Survey gage at Smoky Hill River near Mentor. Period of record: January 1, 1995 to June 30, 2017. Located near SC514 and SC268.

Hydrology

Flow conditions for this TMDL were analyzed using U.S. Geological Survey (USGS) streamgage data from the Smoky Hill River near Mentor (06866500). The gage has streamflow data available for the period of record January 1, 1995 to June 30, 2017. A flow duration curve for the Smoky Hill River near Mentor indicates that this portion of the Smoky Hill River has at least 26 cubic feet per second (cfs) flowing through it 90% of the time and more than 587 cfs flowing through it 10% of the time (**Figure 2**). Flow conditions for Kansas Department of Health and Environment (KDHE) stream chemistry (SC) stations Smoky Hill River near Mentor (SC514) and Smoky Hill River near Salina (SC268) were calculated using a watershed area ratio based upon the USGS streamgage and respective drainage areas (**Table 2**).

Figure 2. Flow duration curve for U.S. Geological Survey gage located in the Smoky Hill River near Mentor (06866500).

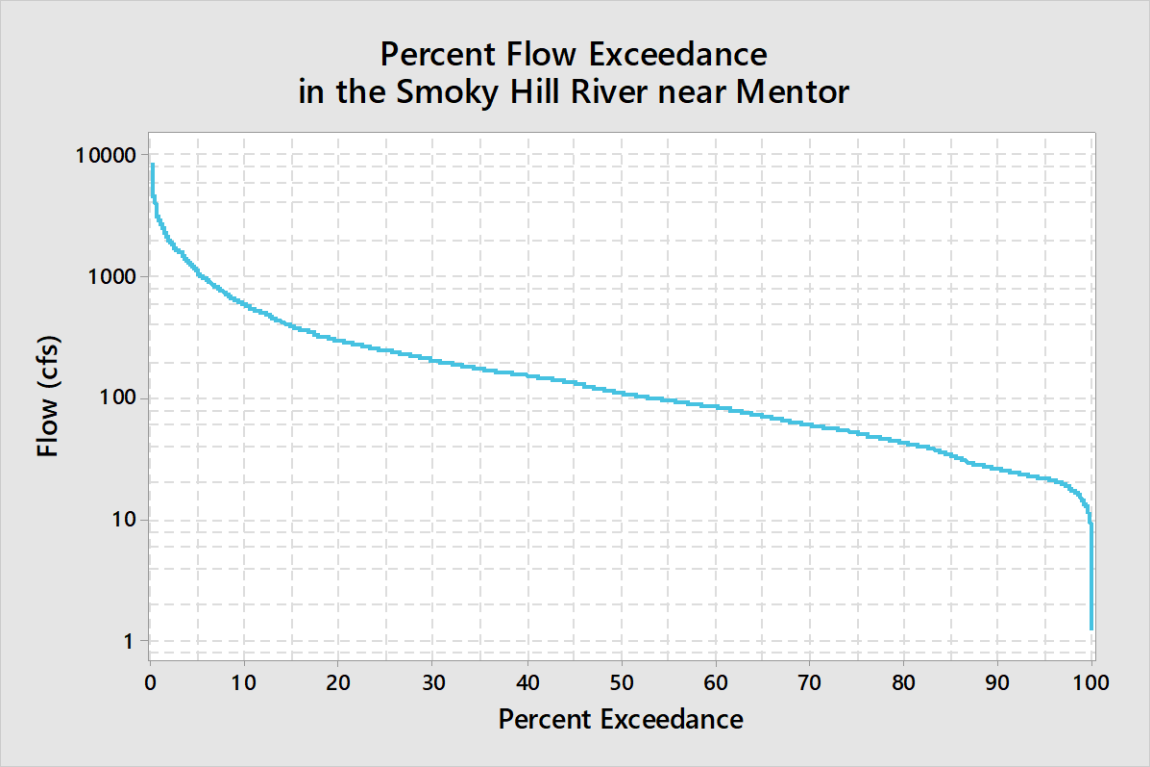


Table 2. Flow conditions and drainage area at U.S. Geological Survey gage and Kansas Department of Health and Environment stream chemistry (SC) stations in the Smoky Hill River near Mentor and Salina.

Stream	Station	Contributing Drainage Area (mi^2)	Mean Flow (cfs)	Percent Flow Exceedance (cfs)				
				90%	75%	50%	25%	10%
Smoky Hill R nr Mentor	06866500	8,341	270	26	51	110	246	587
Smoky Hill R nr Mentor	SC514	8,348	270	26	51	110	246	587
Smoky Hill R nr Salina	SC268	8,509	275	27	52	112	251	599

Long-term estimated flows for the Smoky Hill River and its tributaries can be found in **Table 3** (Perry et. al, 2004). The main tributary to the Smoky Hill River near Mentor (SC514) is Pewee Creek, and the main tributary to the Smoky Hill River near Salina (SC268) is Dry Creek. After Dry Creek enters the Smoky Hill River, the river continues along the outskirts of the City of Salina before its confluence with the Saline River. Previously, the Smoky Hill River ran through the middle of the City of Salina, but the river's course was changed in the 1960s with the addition of a bypass channel and a flood control levee constructed by the U.S. Army Corp of Engineers (City of Salina, 2018). Today, the old riverbed has no base flow but is used as a stormwater channel for the city storm drains.

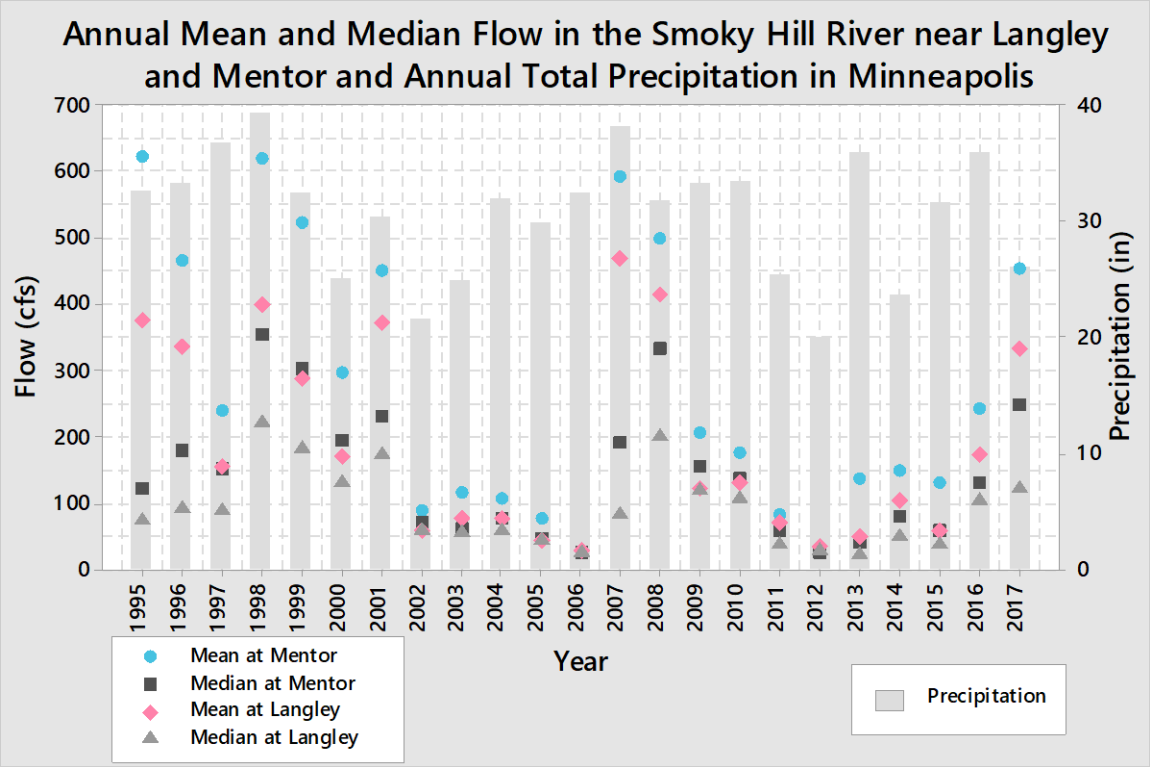
Table 3. U.S. Geological Survey (USGS) long-term estimated flows for the Smoky Hill River and its tributaries (Perry et.al, 2004).

Stream	USGS Site	KSWR CUSEGA Number	County	Drainage Area (mi^2)	Mean Flow (cfs)	Percent Flow Exceedance (cfs)					2-year Peak (cfs)
						90%	75%	50%	25%	10%	
Smoky Hill R	2638	1026000813	SA	8,360	341	34	61	115	272	851	3,570
Pewee Cr	2680	1026000856	MP, SA	11	4	0	0.4	1	2	5	745
Smoky Hill R	**2607**	**1026000813**	**SA**	**8,403**	**351**	**36**	**64**	**120**	**284**	**876**	**3,780**
Dry Cr	2484	1026000836	SA	100	28	0	2	6	16	39	1,720
Smoky Hill R	**2388**	**1026000813**	**SA**	**8,524**	**381**	**41**	**72**	**135**	**315**	**948**	**4,360**

Definitions: SA – Saline; MP – McPherson; **Segments with stream chemistry stations**

The highest mean annual flows at the USGS gage in the Smoky Hill River near Mentor occurred in 1995, 1998, and 2007, with flows of 621, 618, and 590 cfs, respectively (**Figure 3**). The highest median annual flows occurred in 1998 and 2008, with flows of 354 and 332 cfs, respectively. The lowest mean and median annual flows occurred in 2006 and 2012, with means of 26 and 31 cfs, respectively, and medians of 25 and 23 cfs, respectively.

Figure 3. Annual mean and median flows in the Smoky Hill River for U.S. Geological Survey gages 06865500 near Langley (below Kanopolis Reservoir) and 06866500 near Mentor and annual total precipitation at National Oceanic and Atmospheric Association station USC00145363 at Minneapolis, Kansas.



Trends in annual flows generally coincide with National Oceanic and Atmospheric Administration (NOAA) annual total precipitation from station USC00145363 in Minneapolis. The highest annual precipitation occurred in 1998 and 2007, corresponding to some of the years with highest annual flows. The lowest annual precipitation occurred in 2012, corresponding to one of the lowest years of flow. However, flow is most strongly influenced by the presence of Kanopolis Reservoir upstream of this station. Releases from Kanopolis Reservoir, as measured at the USGS gage near Langley (06865500), indicate that the majority of flow in the Smoky Hill River near Mentor is contributed from this reservoir. The peak annual flows in the Smoky Hill River near Mentor occurred in1995 and 1998, with flows of 8,810 and 8,660 cfs, respectively (**Figure 4**). The lowest peak annual flows occurred in 2006 and 2012, with flows of 118 and 258 cfs, respectively. The highest peak annual flows generally coincide more strongly with precipitation and the lowest peak annual flows generally correspond to flow contributed from Kanopolis Reservoir.

Seasonally in the Smoky Hill River near Mentor, high flows occur in spring (April through June) and low flows occur in winter (November through March; **Figure 5**). Spring flows are skewed by high flow events, likely due to precipitation and runoff events, and correspond to higher flows in May and June (**Figure 6**). Meanwhile, winter low flows correspond to the months of January and February.

Figure 4. Annual peak flows for U.S. Geological Survey gages 06865500 near Langley (below Kanopolis Reservoir) and 06866500 near Mentor in the Smoky Hill River.

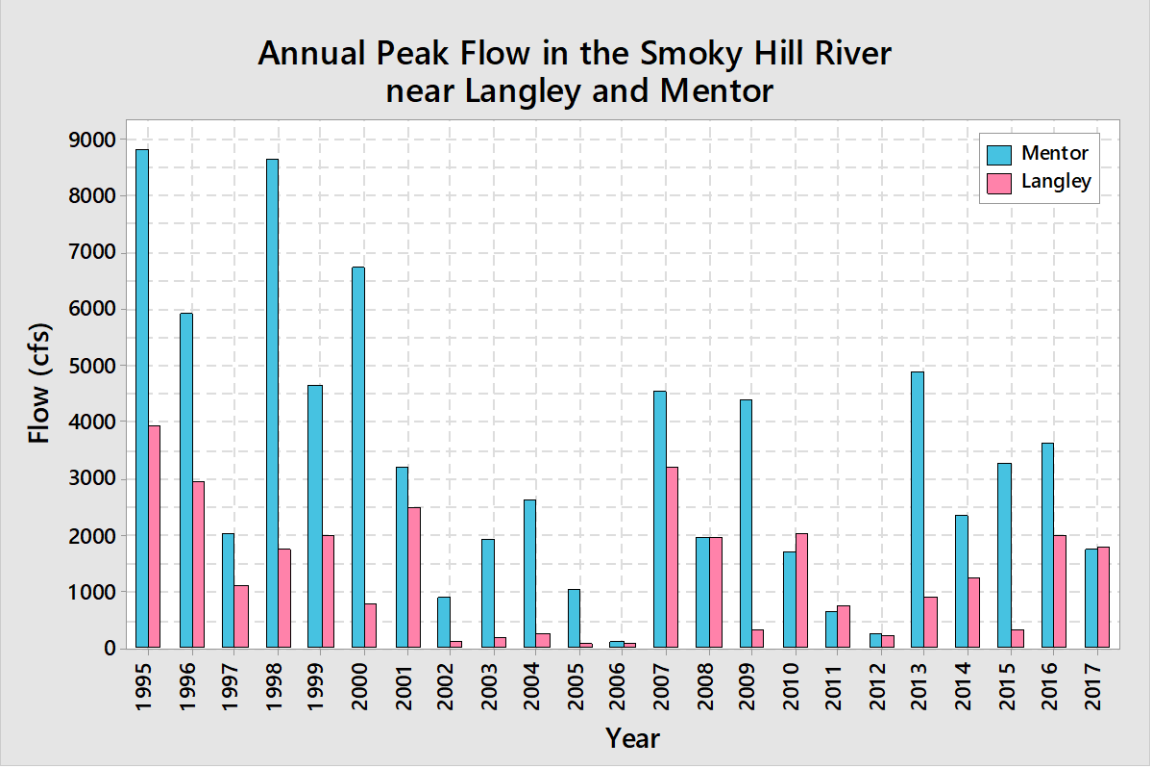


Figure 5. Flows by season for U.S. Geological Survey gage 06866500 near Mentor in the Smoky Hill River.

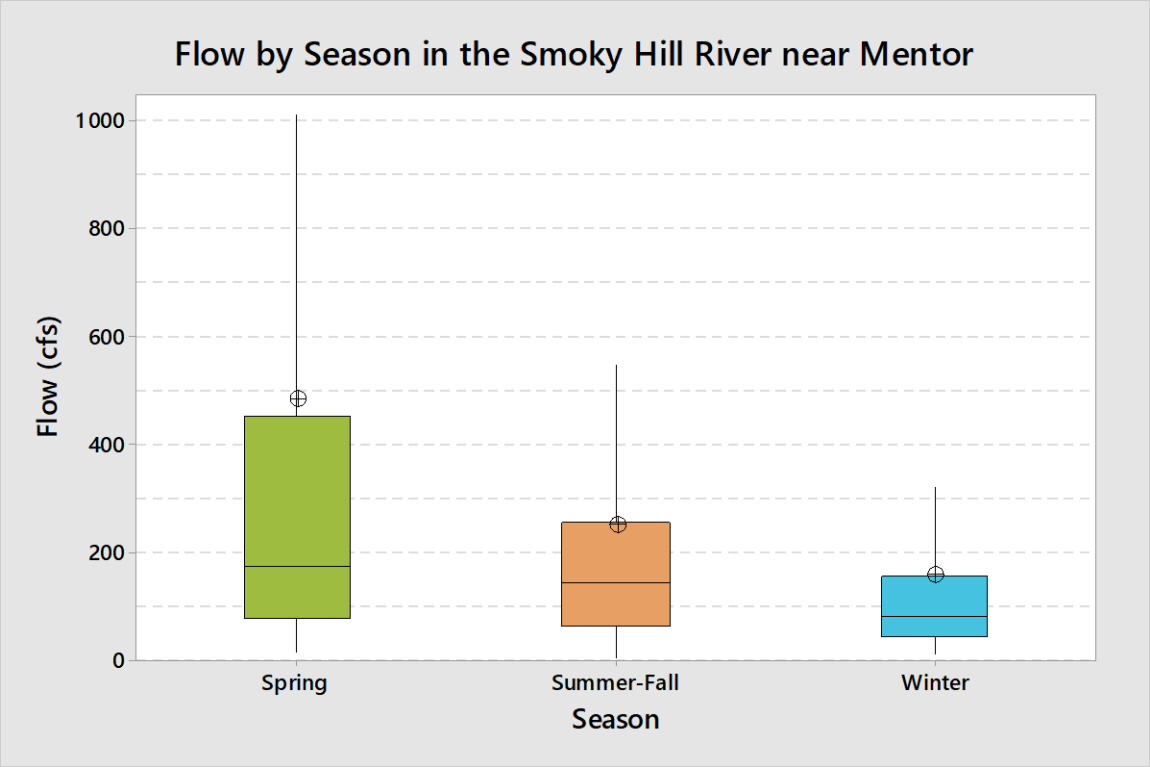
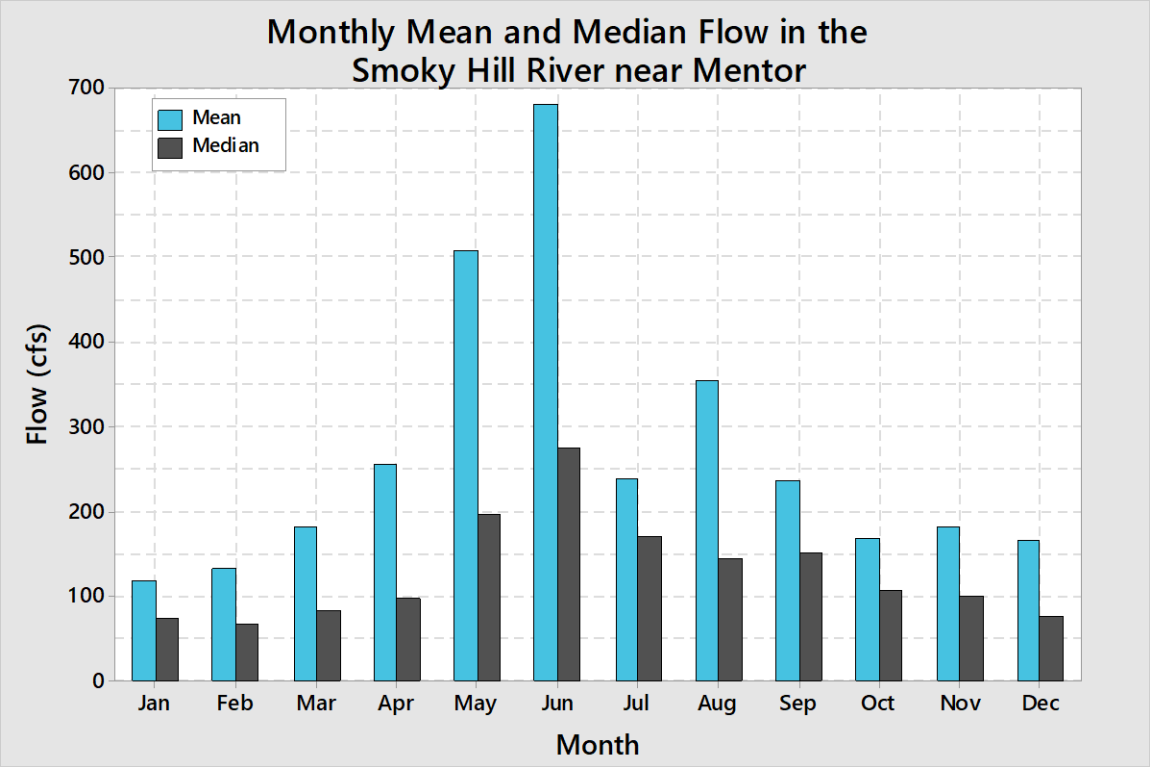


Figure 6. Monthly mean and median flows for U.S. Geological Survey gage 06866500 near Mentor in the Smoky Hill River.



Nitrate as Nitrogen Concentrations

Throughout the period of record, nitrate-n samples at upstream Mentor (SC514) remain consistently low, rarely exceeding 1 mg/L (**Figure 7**). Nitrate-n concentrations near Mentor (SC514) have never exceeded the water quality criterion, and this station is not impaired for nitrate-n. Meanwhile, nitrate-n concentrations at the downstream, impaired Salina (SC268) station are consistently higher. Salina (SC268) has nitrate-n concentration peaks in July 2002, August 2003, July 2006, December 2011, and three months in 2012 (January, July, and October). Nitrate-n concentrations exceeded the numeric water quality criterion of 10 mg/L in July 2006 and October 2012.

Samples collected on concurrent days at Mentor (SC514) and Salina (SC268) indicate that upstream nitrate-n concentrations of less than 1 mg/L can correspond to elevated downstream nitrate-n concentrations ranging from 1 to 11 mg/L (**Figure 8**). Indeed, some of the highest nitrate-n concentrations detected near Salina (SC268) are instances where nitrate-n concentrations were non-detectable near Mentor (SC514). Despite its unimpaired status, Mentor (SC514) is considered for comparison purposes throughout this analysis because it and Salina (SC268) are located on the same impaired river segment (CUSEGA 1026000813).

Figure 7. Nitrate as nitrogen concentrations in the Smoky Hill River near Mentor (SC514) and Salina (SC268).

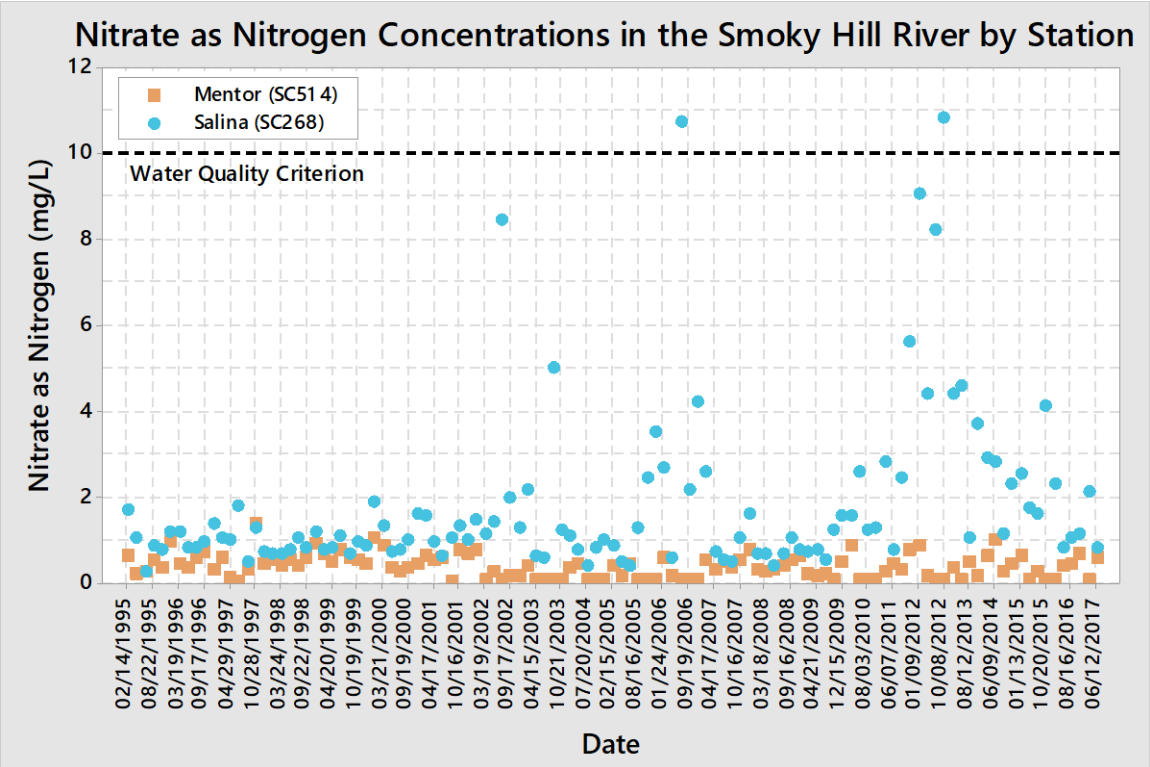
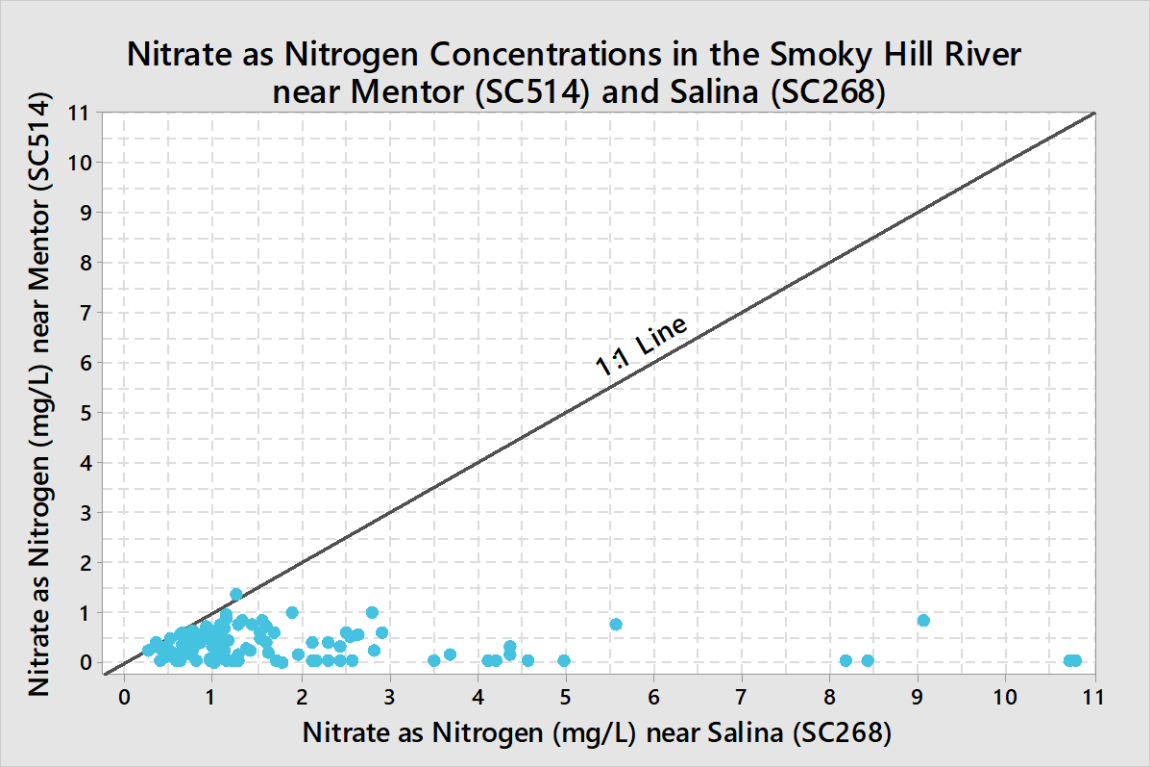


Figure 8. Nitrate as nitrogen concentrations at upstream Mentor (SC514) versus downstream Salina (SC268) for concurrent day samples in the Smoky Hill River.



Downstream annual nitrate-n concentration means, medians, and maximums are typically at least twice the upstream nitrate-n concentrations (**Table 4**). Mean and median annual nitrate-n concentrations near Mentor (SC514) remain below 0.6 mg/L throughout the period of record, with some of the lowest means and medians occurring from 2002 to 2006, coinciding with an extended period of low flow conditions (**Figures 9-10**). In contrast, mean and median nitrate-n concentrations near Salina (SC268) tend to increase during years with low flow conditions, such as the increases seen in 2002, 2006, and 2012. This trend is especially clear for annual peak nitrate-n concentrations, when nitrate-n concentrations near Salina (SC268) increase while nitrate-n concentrations near Mentor (SC514) remain consistent or even decrease (**Figure 11**).

Table 4. Annual nitrate as nitrogen mean, median, maximum, number of sampled excursions (nitrate as nitrogen concentrations greater than 10 mg/L), and number of samples (N) in the Smoky Hill River near Mentor (SC514) and Salina (SC268).

Year	Mentor (SC514) Nitrate as Nitrogen (mg/L)					Salina (SC268) Nitrate as Nitrogen (mg/L)				
	Mean	Median	Maximum	Excursions	N	Mean	Median	Maximum	Excursions	N
1995	0.46	0.42	0.94	0	6	0.94	0.92	1.7	0	6
1996	0.46	0.44	0.70	0	5	1.0	0.91	1.4	0	5
1997	0.45	0.36	1.4	0	6	1.0	1.0	1.8	0	6
1998	0.53	0.53	0.87	0	6	0.83	0.78	1.1	0	6
1999	0.56	0.56	0.74	0	6	0.83	0.82	1.1	0	6
2000	0.53	0.38	1.0	0	6	1.2	1.1	1.9	0	6
2001	0.51	0.57	0.74	0	6	1.1	1.0	1.5	0	6
2002	0.23	0.16	0.75	0	6	2.6	1.4	8.4	0	6
2003	0.12	0.05	0.38	0	5	1.9	1.2	5.0	0	5
2004	0.18	0.05	0.42	0	5	0.80	0.80	1.1	0	5
2005	0.18	0.09	0.41	0	6	1.5	1.0	3.5	0	6
2006	0.17	0.05	0.55	0	5	4.1	2.6	**11**	**1**	5
2007	0.47	0.49	0.73	0	6	1.1	0.85	2.5	0	6
2008	0.38	0.33	0.61	0	6	0.69	0.67	1.0	0	6
2009	0.21	0.19	0.47	0	5	0.94	0.73	1.5	0	5
2010	0.24	0.05	0.82	0	4	1.7	1.4	2.6	0	4
2011	0.43	0.37	0.75	0	4	2.9	2.6	5.6	0	4
2012	0.27	0.10	0.83	0	4	8.1	8.6	**11**	**1**	4
2013	0.25	0.24	0.45	0	4	3.4	4.0	4.5	0	4
2014	0.56	0.50	0.99	0	4	2.3	2.6	2.9	0	4
2015	0.23	0.13	0.60	0	4	2.5	2.1	4.1	0	4
2016	0.38	0.40	0.67	0	4	1.3	1.1	2.3	0	4
2017	0.30	0.30	0.54	0	2	1.4	1.4	2.1	0	2

Figure 9. Annual mean nitrate as nitrogen concentrations near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.

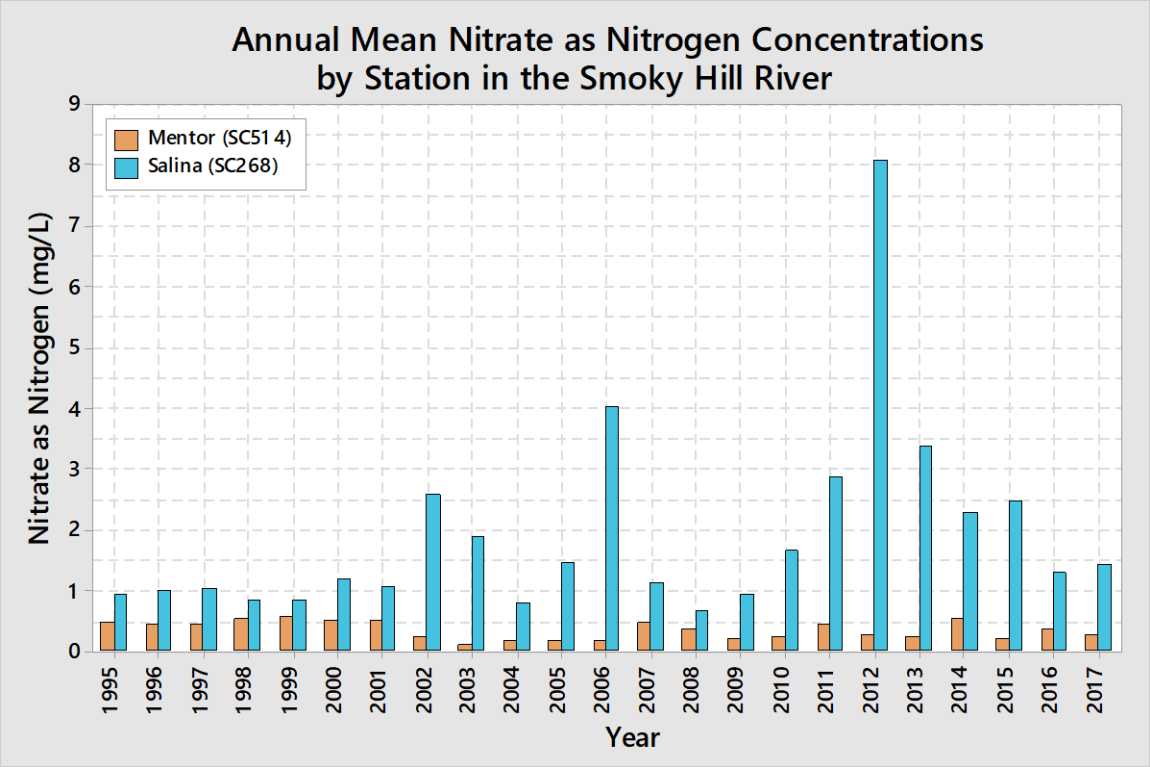


Figure 10. Annual median nitrate as nitrogen concentrations near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.

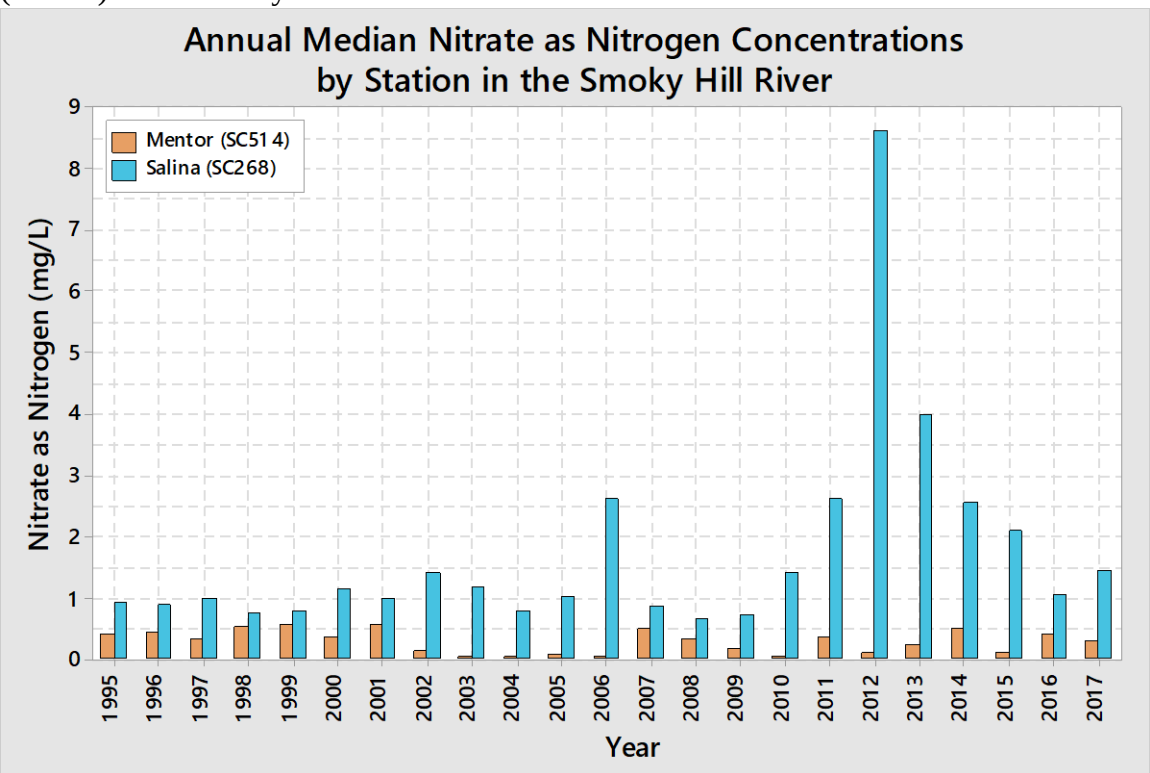
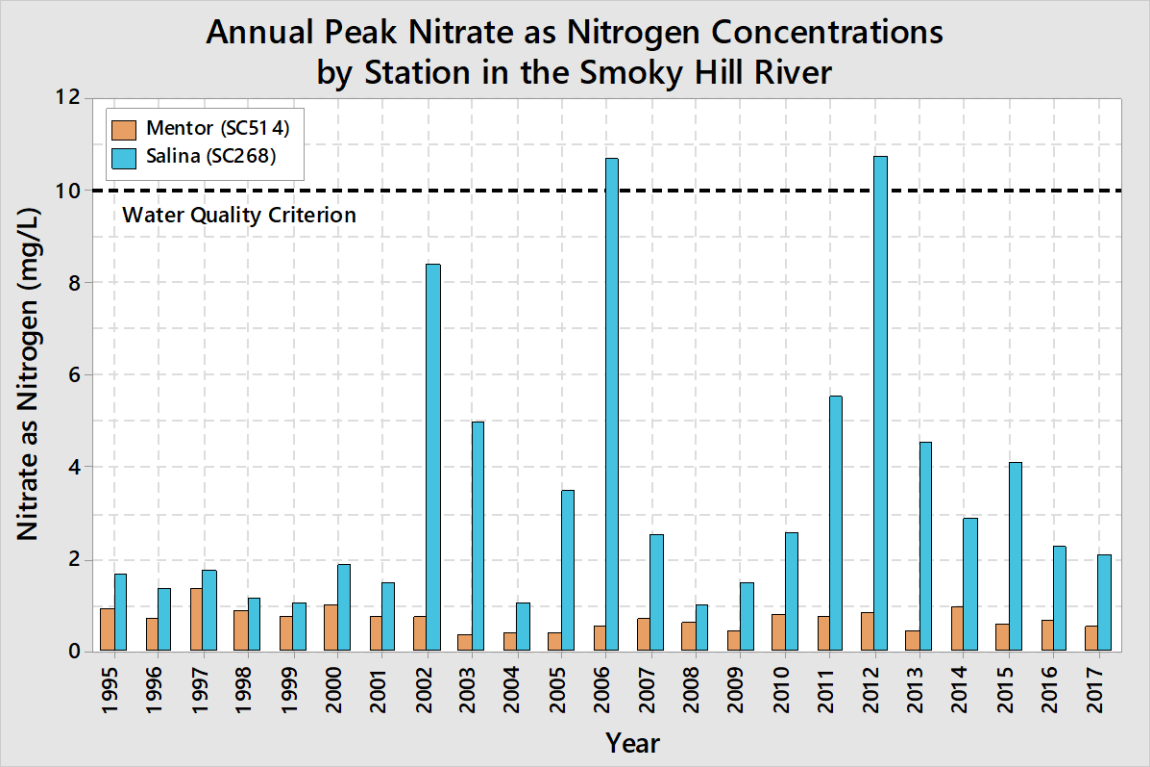


Figure 11. Annual peak nitrate as nitrogen concentrations near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.



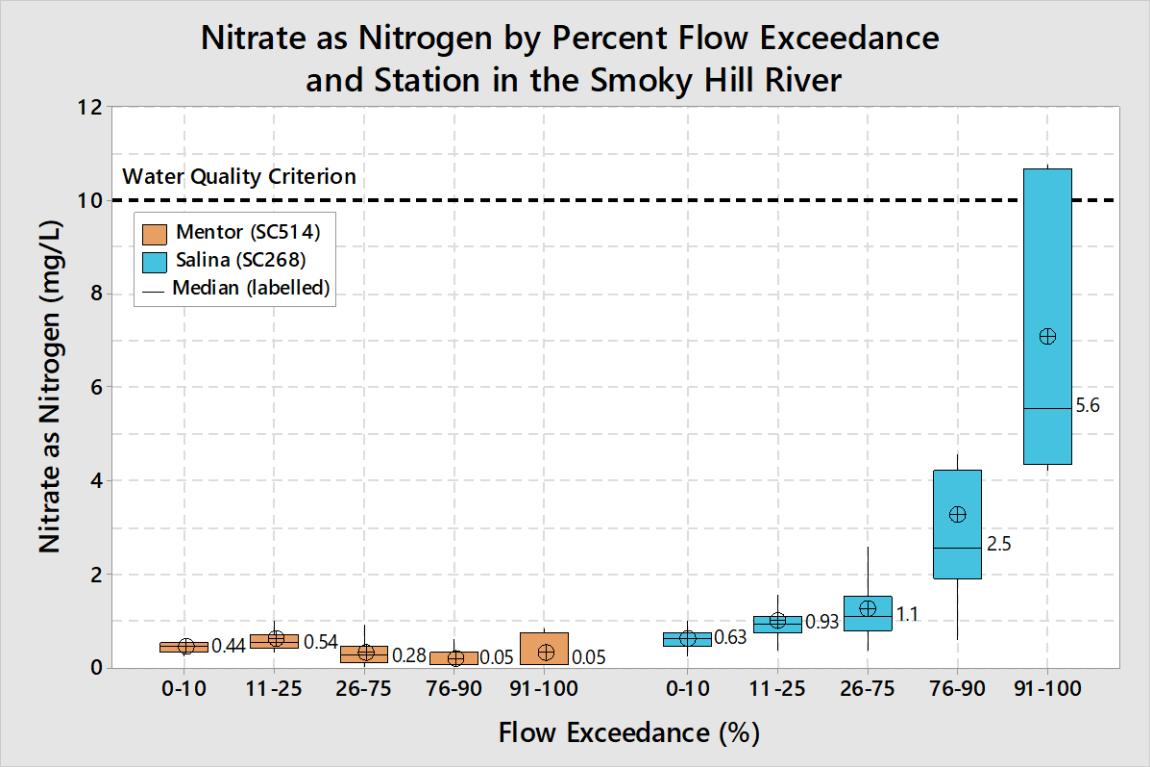
Nitrate-n concentration summaries by season and percent flow exceedance conditions are presented in **Table 5**. Overall, downstream nitrate-n concentration means are five times greater than upstream concentrations: Salina (SC268) has a mean nitrate-n concentration of 1.8 mg/L and Mentor (SC514) has a mean nitrate-n concentration of 0.36 mg/L. Similarly, downstream median nitrate-n concentrations are more than three times greater than upstream concentrations: Salina (SC268) has a median nitrate-n concentration of 1.1 mg/L and Mentor (SC514) has a median nitrate-n concentration of 0.34 mg/L. Additionally, the overall range of nitrate-n concentrations varies considerably between stations: Salina (SC268) ranges from 0.25 to 11 mg/L, while Mentor (SC514) ranges from 0.01 to 1.4 mg/L.

Across the flow ranges, Mentor (SC514) has higher nitrate-n mean, median, and maximum concentrations during high flow conditions (0 to 25%; **Table 5**; **Figure 12**). During low flow conditions (76 to 100%), this station frequently has non-detectable levels of nitrate-n. In contrast, Salina (SC268) nitrate-n mean, median, and maximum concentrations increase consistently from high to low flow conditions, with concentrations exceeding the numeric water quality criterion of 10 mg/L only during the lowest flow conditions (91 to 100%). This trend indicates that nitrate-n concentrations near Mentor (SC514) are dominated by nonpoint sources during high flow conditions, while nitrate-n concentrations near Salina (SC268) are dominated by point sources during low flow conditions in this section of the Smoky Hill River.

Table 5. Nitrate as nitrogen mean, median, maximum and number of samples (N) by season (spring: April through June, summer-fall: July through October, winter: November through March) and percent flow exceedance near Mentor (SC514) and Salina (SC268) in the Smoky Hill River. Values with no data are denoted with a – symbol.

Flow Exceedance (%)	Mentor (SC514) Nitrate as Nitrogen (mg/L)				Salina (SC268) Nitrate as Nitrogen (mg/L)			
	Mean	Median	Maximum	N	Mean	Median	Maximum	N
Spring								
0-10	0.42	0.44	0.54	7	0.58	0.62	0.78	7
11-25	0.57	0.50	0.99	7	1.1	0.79	2.8	7
26-75	0.16	0.14	0.38	13	0.99	0.79	2.6	13
76-90	0.10	0.10	0.16	4	2.8	3.0	4.5	4
91-100	–	–	–	–	–	–	–	–
0-100	**0.30**	**0.27**	**0.99**	**31**	**1.1**	**0.76**	**4.5**	**31**
Summer-Fall								
0-10	0.47	0.53	0.58	3	0.69	0.63	1.0	3
11-25	0.65	0.53	1.4	6	0.91	0.96	1.2	6
26-75	0.27	0.27	0.74	20	1.1	1.0	2.4	20
76-90	0.05	0.05	0.05	6	4.4	3.3	8.4	6
91-100	0.05	0.05	0.05	3	8.8	11	11	3
0-100	**0.30**	**0.27**	**1.4**	**38**	**2.2**	**1.0**	**11**	**38**
Winter								
0-10	0.35	0.35	0.35	1	0.64	0.64	0.64	1
11-25	0.60	0.61	0.87	9	1.0	0.99	1.6	9
26-75	0.43	0.38	1.0	25	1.5	1.3	3.7	25
76-90	0.34	0.52	0.60	7	2.5	2.5	3.5	7
91-100	0.49	0.54	0.83	4	5.8	5.0	9.0	4
0-100	**0.45**	**0.43**	**1.0**	**46**	**1.9**	**1.4**	**9.0**	**46**
All Seasons								
0-10	0.43	0.44	0.58	11	0.61	0.63	1.0	11
11-25	0.60	0.54	1.4	22	1.0	0.93	2.8	22
26-75	0.32	0.28	1.0	58	1.2	1.1	3.7	58
76-90	0.18	0.05	0.60	17	3.2	2.5	8.4	17
91-100	0.30	0.05	0.83	7	7.1	5.6	11	7
0-100	**0.36**	**0.34**	**1.4**	**115**	**1.8**	**1.1**	**11**	**115**

Figure 12. Nitrate as nitrogen concentrations by percent flow exceedance near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.



Consistent with the previously noted trend, nitrate-n concentrations near Mentor (SC514) are highest during high flow conditions which predominate in the spring and summer-fall (July through October; **Table 5**; **Figure 13**); however, during normal (26 to 75%) and low flow conditions, spring and summer-fall nitrate-n concentrations transition to becoming non-detectable. Meanwhile, winter nitrate-n concentrations remain consistent throughout all flow conditions, with detections becoming more predominant during normal and low flow conditions. Conversely, nitrate-n concentrations near Salina (SC268) increase as flows decline. High and normal flow conditions occur throughout all seasons near Salina (SC268), with nitrate-n concentrations typically remaining below 3 mg/L during these flow conditions (**Figure 14**). Low flow conditions, however, have higher nitrate-n concentrations and are dominated by summer-fall and winter samples, with both nitrate-n water quality criterion excursions occurring during summer-fall.

Near Mentor (SC514), the highest monthly mean and median nitrate-n concentrations occur in December and January, while the lowest monthly mean and median concentrations occur in April, July, and November (**Figure 15**). Near Salina (SC268), the highest monthly mean nitrate-n concentrations occur in January, July, and October, while the highest monthly median nitrate-n concentrations occur in January and February (**Figure 16**). The lowest monthly mean and median nitrate-n concentrations near Salina (SC268) occur in April, May, and June.

Figure 13. Nitrate as nitrogen concentrations by percent flow exceedance near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.

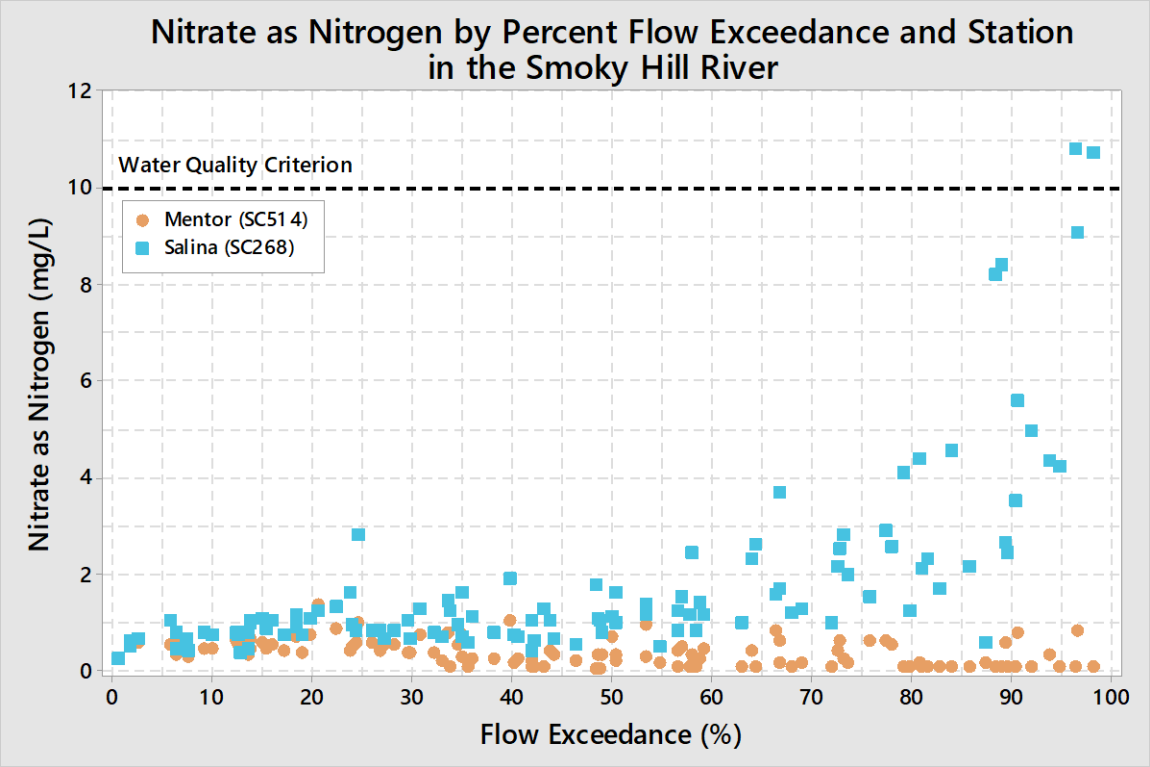


Figure 14. Nitrate as nitrogen concentrations by percent flow exceedance and season near Salina (SC268) in the Smoky Hill River.

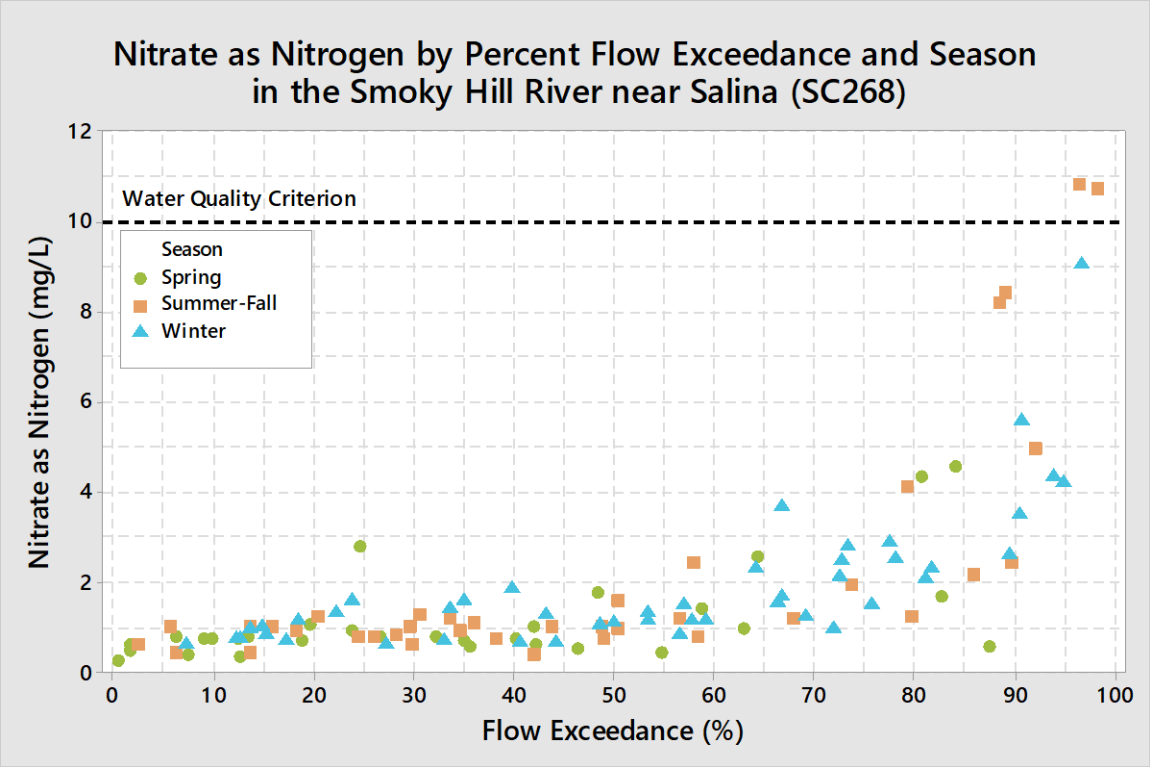


Figure 15. Monthly mean nitrate as nitrogen concentrations near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.

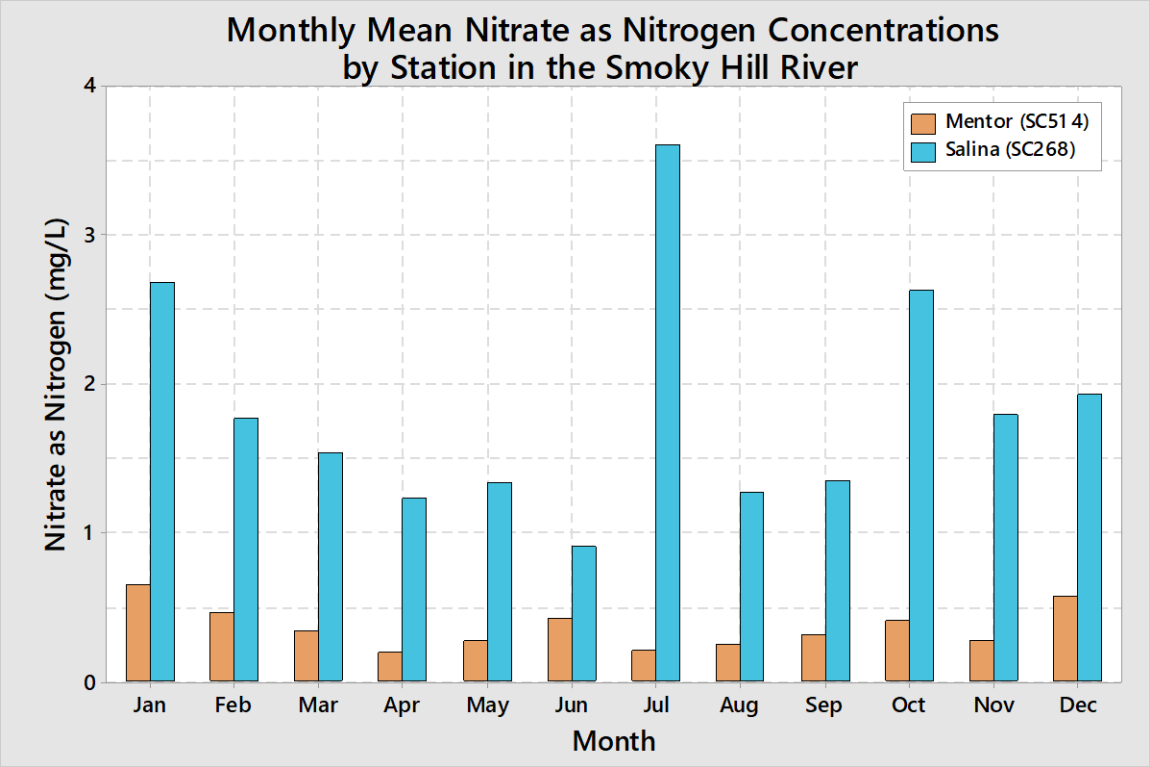
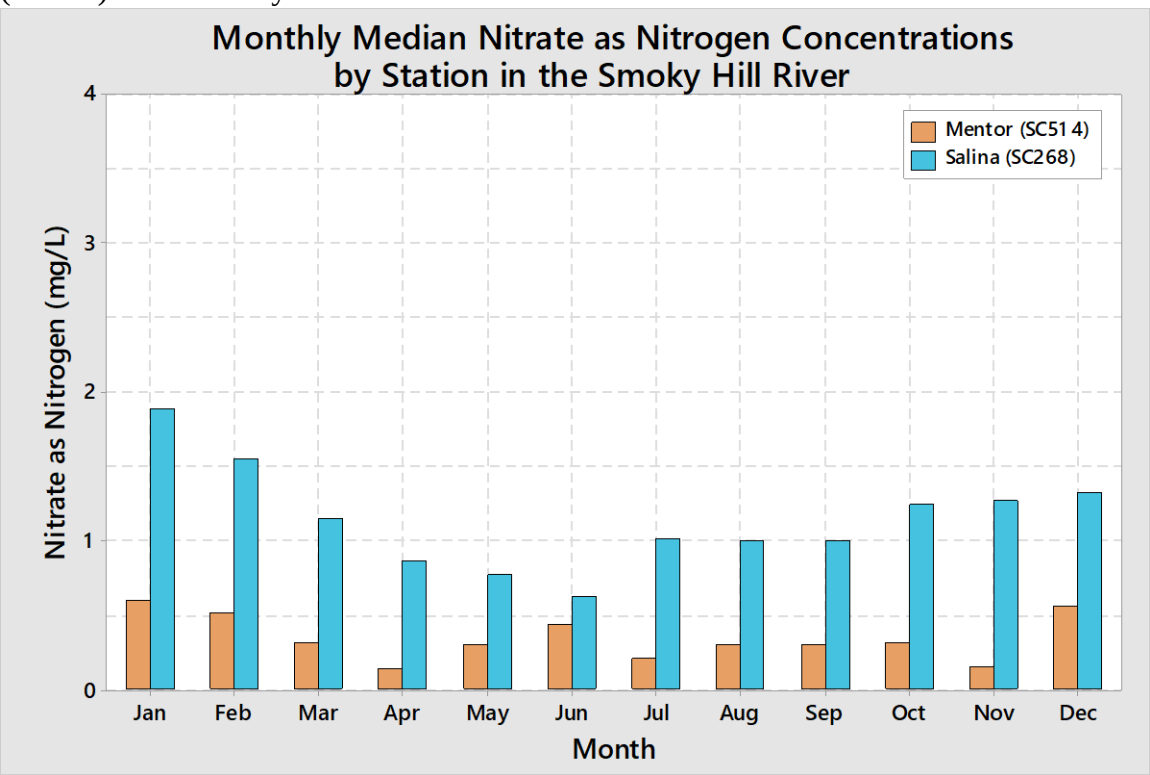
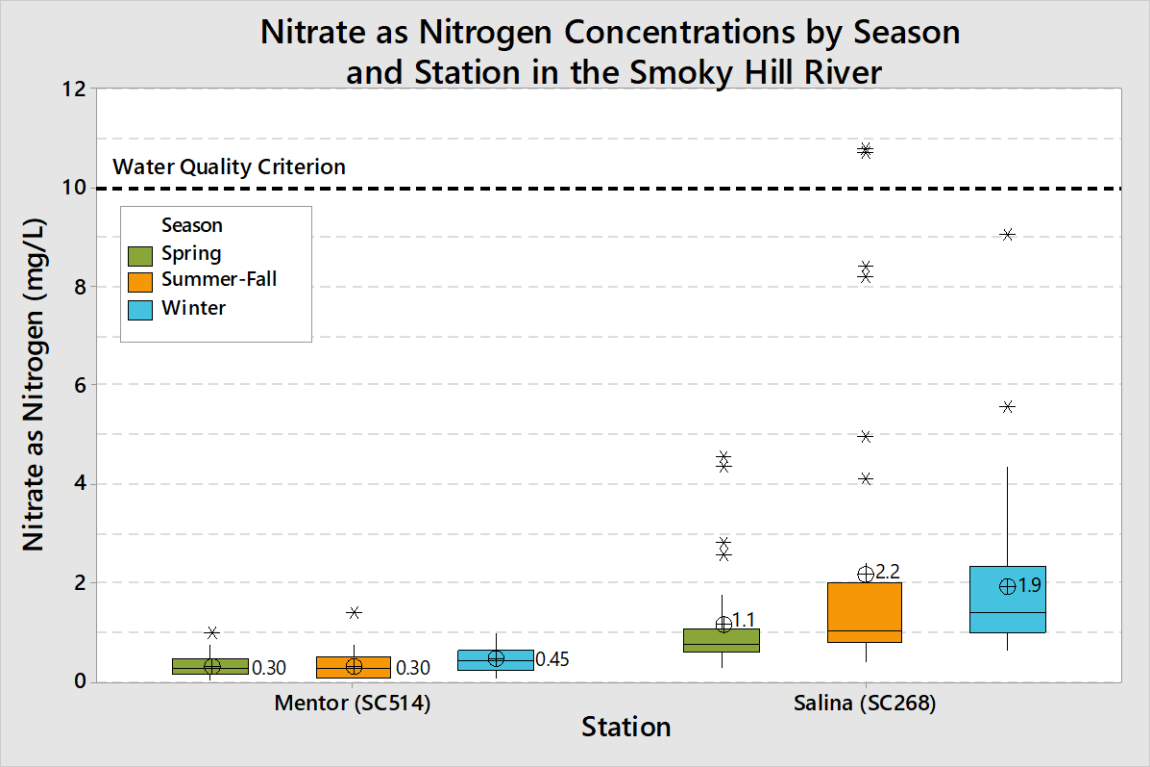


Figure 16. Monthly median nitrate as nitrogen concentrations near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.



Monthly trends are reflected across the seasons, as well. Near Mentor (SC514), nitrate-n mean and medians increase marginally during winter, while remaining consistent in spring and summer-fall (**Figure 17**). This trend likely is a result of reduced biological nitrate uptake during the winter. Near Salina (SC268), mean nitrate-n concentrations double from spring (1.1 mg/L) to summer-fall (2.2 mg/L) before declining in winter (1.9 mg/L); meanwhile, median nitrate-n concentrations near Salina (SC268) increase consistently from spring to winter. These trends likely are a result of dilution from precipitation and runoff in spring and reduced precipitation in summer–fall and winter.

Figure 17. Nitrate as nitrogen concentrations by season near Mentor (SC514) and Salina (SC268) in the Smoky Hill River.



Desired Endpoint

The ultimate endpoint of this TMDL will be to achieve the Kansas Water Quality Standards by reducing nitrate-n levels to attain full support of special aquatic life, domestic water supply and recreational uses in the river. The numeric endpoint for this TMDL is 10 mg/L nitrate-n. The 10 mg/L nitrate-n criterion is specific to the domestic water supply use (Kansas Surface Water Quality Standards: Tables of Numeric Criteria, 2017); however, it will also serve to protect the designated uses for primary contact recreation (British Columbia Ministry of Environment and Climate Strategy, 2017), should water be accidentally ingested, and expected aquatic life uses (U. S. Environmental Protection Agency, 2010). Nitrate-n concentrations in the Smoky Hill River near Salina (SC268) must not measure greater than 10 mg/L more than once in the most recent 10-year period of record to be considered for delisting. Achievement of this endpoint

indicates nitrate-n loads are within the loading capacity of the stream, water quality standards are attained, and full support of the designated uses of the stream are restored.

3. SOURCE INVENTORY AND ASSESSMENT

Point Sources

There are a total of seven National Pollution Discharge Elimination System (NPDES) permitted facilities within the Smoky Hill River near Salina (SC268) Watershed (**Figure 1**; **Table 9**). Of the seven permitted facilities, one is a non-discharging lagoon, one is an industrial quarry dewatering pit, two are municipal discharging lagoons, two are facilities implementing groundwater remediation, and one is a municipal mechanical wastewater treatment plant (WWTP). Additionally, there is one Municipal Separate Storm Sewer System (MS4) permit within the watershed.

The non-discharging lagoon within the watershed is operated by Falun Improvement District. It is a two-cell lagoon system that is prohibited from discharging. This system does not monitor for nitrate-n and is not expected to contribute to the nitrate-n impairment in the watershed.

The industrial quarry dewatering pit facility within the watershed is operated by Buildex, Inc. (Shale Quarry-Marquette), a shale mining company. This facility has three outfalls, two of which discharge from shale dewatering pits that are also used to retain stormwater runoff; the third outfall is inactive as of 2016, when the company built a berm. As of the 2016 inspection, Buildex, Inc. (Shale Quarry-Marquette) has not discharged to Dry Creek. This system does not monitor for nitrate-n and is not expected to contribute to the nitrate-n impairment in the watershed.

The two municipal discharging lagoons within the watershed are operated by the City of Assaria and the City of Smolan. Both facilities treat domestic waste in a three-cell lagoon system. Previously, the City of Smolan operated a non-discharging lagoon, but this facility was upgraded to a discharging lagoon in 2011. Both facilities are required to monitor nitrate plus nitrite data quarterly, when discharging; however, they are currently not required to report the discharge volume. According to the facility's Discharge Monitoring Report (DMR) period of record (September 2004 to December 2017), the City of Assaria discharged to the Smoky Hill River during approximately 55% of the quarters, but has not discharged since the first quarter of 2014. According to the facility's DMR period of record (May 2013 to September 2017), the City of Smolan discharged to Dry Creek via an unnamed tributary during approximately 44% of the quarters. The discharging lagoons for the City of Assaria and the City of Smolan are assigned a nitrate-n wasteload allocation (WLA) under this TMDL.

The two facilities implementing groundwater remediation are Smolan Pork Site Groundwater Remediation and Matador Cattle Company. Smolan Pork Site Groundwater Remediation is removing tetrachloride and ethylene dibromide from five wells with an air stripper and filter before discharging to a tributary of Dry Creek. According to the facility's DMR period of record

(May 2013 to November 2017), the facility discharged 0.056 million gallons per day (MGD). This facility monitors annually for nitrate-n and has collected data from 2013 to 2017; during this time, it discharged a flow weighted mean of 7.6 mg/L nitrate-n. In total, the facility discharged 3.56 pounds per day (lbs/day) nitrate-n. Matador Cattle Company is removing volatile organic compounds from three separate wells with an air stripper. A sequestrant is added prior to treatment with the air stripper and groundwater is discharged through two outfalls to the former Smoky Hill River bed in Salina. According to the facility's DMR period of record (December 2010 to September 2017), outfall 001A1 discharged 0.093 million gallons per day (MGD) and outfall 002A1 discharged 0.29 MGD, totaling 0.383 MGD. This facility monitored annually for nitrate plus nitrite at outfall 002A1 from 2011 to 2015; during this time, it discharged a mean of 1.1 mg/L nitrate plus nitrite, with an estimated load of 3.52 lbs/day. While this facility is not considered a major source of nitrate-n, increasing levels of nitrate in groundwater in this region (Townsend et al., 2001) do make it a source of concern. As such, the Smolan Pork Site Groundwater Remediation and Matador Cattle Company are assigned nitrate-n WLAs under this TMDL.

The municipal mechanical WWTP within the watershed is operated by the City of Salina. According to the facility's DMR period of record (January 2003 to November 2017), this facility currently operates at 4.2 MGD, making it the largest discharger to the Smoky Hill River. The WWTP is designed for nutrient removal via activated sludge. Additionally, the facility is allowed to use reclaimed wastewater effluent for irrigating a golf course, allowing nutrient-rich waters to be utilized more efficiently. Currently, the City of Salina WWTP has a monthly monitoring requirement for nitrate plus nitrite. From 2003 to 2009, this facility was required to monitor nitrate and nitrite as separate constituents on a monthly basis. In 2010, monitoring requirements changed to the single constituent of nitrate plus nitrite on a monthly basis. Despite the combination of nitrate plus nitrite in the current reporting requirements, the 2003 to 2009 monitoring data demonstrates that the majority of the discharge from this facility is comprised of nitrate: mean nitrite is 1.96 mg/L and mean nitrate is 23.4 mg/L for the period of record. From 2003 to 2017, the discharge from this facility has a mean nitrate plus nitrite concentration of 27 mg/L, with an estimated load of 930 lbs/day.

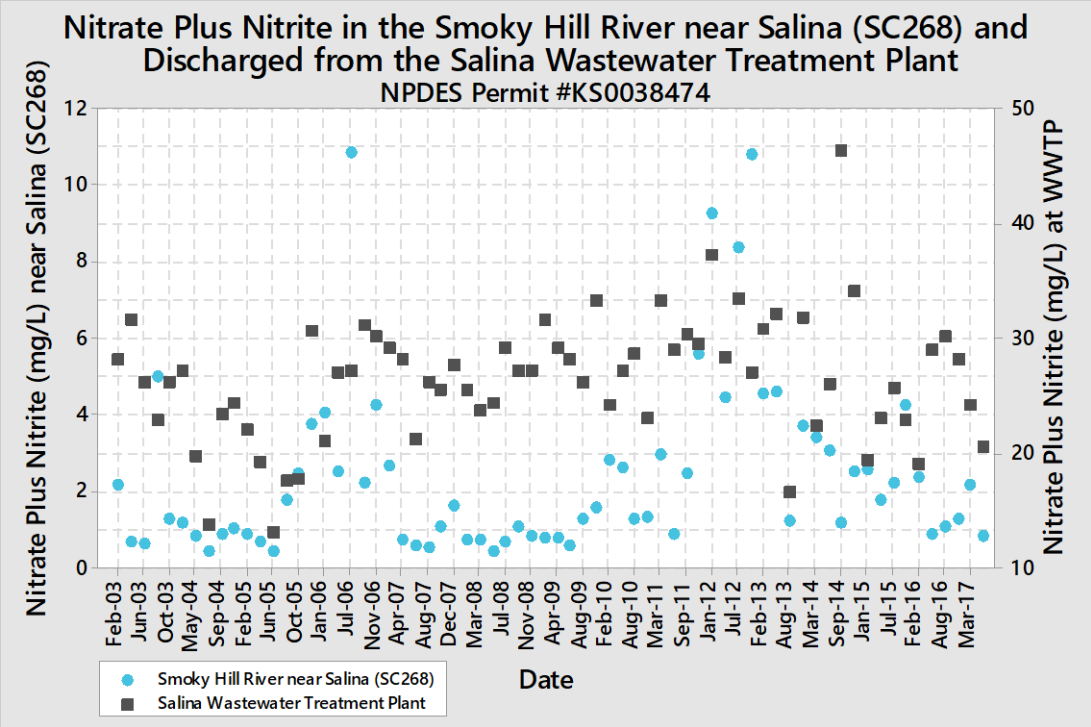
The influence of the WWTP discharge in the watershed was additionally evaluated by comparing the monthly nitrate plus nitrite concentrations in the effluent of the City of Salina WWTP to the monthly nitrate plus nitrite concentrations in the Smoky Hill River near Salina (SC268; **Figure 19**). Where monthly concomitant data were available, there is a general trend that corresponds to nitrate plus nitrite in effluent from the WWTP discharge elevating nitrate plus nitrite concentrations in the Smoky Hill River near Salina (SC268). The City of Salina WWTP is assigned a TP WLA under this TMDL.

Table 9. National Pollution Discharge Elimination System (NPDES) facilities in the Smoky Hill River near Salina (SC268) Watershed.

Permitee	Kansas Permit Number	NPDES Permit Number	Facility Type	Receiv-ing Stream	Permit Expiration	Monitoring Frequency	Current Flow (MGD)	Current Nitrate as Nitrogen Mean Concentra-tion (mg/L)	Current Nitrate as Nitrogen Load (lbs/day)
Falun Improve-ment District	M-SH51-NO01	KSJ000298	Non-discharging Lagoon	NA	05/31/2020	NA	0	NA	NA
Buildex Inc. (Shale Quarry-Marquette)	I-SH25-PO01	KS0095524	Industrial quarry – dewatering pit	Dry Creek	12/31/2019	NA	–	NA	NA
City of Assaria	M-SH02-OO01	KS0082295	Municipal discharging lagoon	Smoky Hill River	09/30/2019	Quarterly	–	–	–
City of Smolan	M-SH36-OO01	KS0099317	Municipal discharging lagoon	Dry Creek	12/31/2021	Quarterly	–	–	–
Smolan Pork Site Groundwater Remediation	I-SH36-PO01	KS0100404	Industrial groundwater remediation	Dry Creek	10/31/2022	Annually	0.056	7.6	3.56
Matador Cattle Company	I-SH33-PO12	KS0099996	Industrial groundwater remediation	Former Smoky Hill River Channel	10/31/2020	NA	0.383	1.1	3.52
City of Salina	M-SH33-IO01	KS0038474	Municipal mechanical wastewater treatment plant	Smoky Hill River	12/31/2019	Monthly	4.2	27	930

Definitions: NA – not applicable; – - data not available

Figure 19. Nitrate plus nitrite in the Smoky Hill River near Salina (SC268) and discharged in effluent from the City of Salina Wastewater Treatment Plant, February 2003 to June 2017.



Municipal Separate Storm Sewer Systems

The only MS4 permit within the Smoky Hill River near Salina (SC268) Watershed authorizes the City of Salina to discharge stormwater (**Table 10**). Under this permit, the city is expected to develop a Stormwater Management Plan (SMP) and implement Best Management Practices (BMPs) within its jurisdiction in order to reduce pollutant loading to waterbodies during rainfall events. Excessive nitrate concentrations from urban stormwater are associated with an increase in nitrate with increased streamflow; however, sites dominated by WWTP point sources can display a decrease in nitrate with increased streamflow, due to the effects of dilution (Graham et al., 2014). As municipal stormwater runoff is not considered to be contributing to the nitrate-n impairment, no nitrate-n WLA is assigned to the permitted MS4.

Table 10. National Pollution Discharge Elimination System (NPDES) Municipal Separate Storm Sewer System permits in the Smoky Hill River.

Permitee	KS Permit Number	NPDES Permit Number	Permit Expiration
City of Salina	M-SH33-SN01	KSR440018	01/31/2019

Livestock and Waste Management Systems

There are 18 certified or permitted Animal Feeding Operations (AFOs) and Concentrated Animal Feeding Operations (CAFOs) within the Smoky Hill River near Salina (SC268) Watershed, three of which are large enough to require a federal permit (KS0038041/A-SASA-HO01, KS0099597/A-SHMP-CO02, and KS0045489/A-SHSA-CO01; **Figure 1**; **Table 11**).

Table 11. Certified or permitted Animal Feeding Operations and Concentrated Animal Feeding Operations in the Smoky Hill River near Salina (SC268) Watershed.

KS Permit Number	County	Livestock Type	Livestock Total
A-SAMP-BA01	McPherson	Beef	100
A-SASA-BA01	Saline	Beef	300
A-SASA-BA10	Saline	Beef	150
A-SASA-BA12	Saline	Beef	300
A-SASA-BA13	Saline	Beef	300
A-SASA-HO01	**Saline**	**Swine**	**20,568**
A-SHMP-BA08	McPherson	Beef	40
A-SHMP-CO02	**McPherson**	**Beef**	**2,000**
A-SHSA-BA01	Saline	Beef	598
A-SHSA-BA05	Saline	Beef	300
A-SHSA-BA17	Saline	Beef	200
A-SHSA-BO06	Saline	Beef	250
A-SHSA-BO07	Saline	Beef	750
A-SHSA-BO08	Saline	Beef	300
A-SHSA-BO09	Saline	Beef	299
A-SHSA-BO10	Saline	Beef	998
A-SHSA-CO01	**Saline**	**Beef**	**9,000**
A-SHSA-MO06	Saline	Dairy	180

Definitions: **Federal Permit**

All of these livestock facilities have waste management systems designed to retain an anticipated two weeks of normal wastewater from their operations and contain a 25-year, 24-hour rainfall/runoff event, as well. Typically, this rainfall event coincides with streamflow that occurs less than 1-5% of the time. Additionally, facility waste management systems are designed to minimize runoff entering operations and detain runoff emanating from operations. It is unlikely nitrate-n loading would be attributable to properly operating permitted facilities, though extensive loading may occur if of these facilities were in violation and discharged.

The total number of livestock in Saline County is approximately 29,600 (**Table 12**; U.S. Department of Agriculture, 2012). The primary livestock industry is cattle, with approximately 24,600 cattle and calves in the county. From 2007 to 2012, livestock has declined by 28% in the county, with the only increase in livestock occurring in sheep and lamb (5%). No livestock facilities within the watershed are permitted to discharge and all are therefore assigned a WLA of 0 lbs/day.

Table 12. Agricultural census results for livestock in Saline County, 2007 and 2012 (U.S. Department of Agriculture, 2012).

Livestock	Total, 2007	Total, 2012	Percent Change
Cattle and Calves	34,581	24,578	-29
Sheep and Lambs	2,020	2,123	5
Poultry	1,842	1,188	-36
Hogs and Pigs	806	322	-60
Goats	678	569	-16
Equine	1,086	796	-27
Total	**41,013**	**29,576**	**-28**

Land Use

The majority of the Smoky Hill River near Salina (SC268) Watershed is within Saline County. Saline County has approximately 364,000 acres of cropland and 674 farms as of 2012, a decline of 15% and 10%, respectively, since 2007 (**Table 13**; U.S. Department of Agriculture, 2012). The 2011 National Land Cover Database indicates the dominant land use in the watershed is cultivated crops, with 48% of the watershed currently used for crop cultivation (**Table 14**; **Figure 20**). Cultivated crops typically use nitrogen fertilizers, potentially contributing to elevated nitrate-n in runoff. Grassland, including pastureland and hay fields, is the second most prevalent land use in the watershed, with 36% of the watershed in grassland.

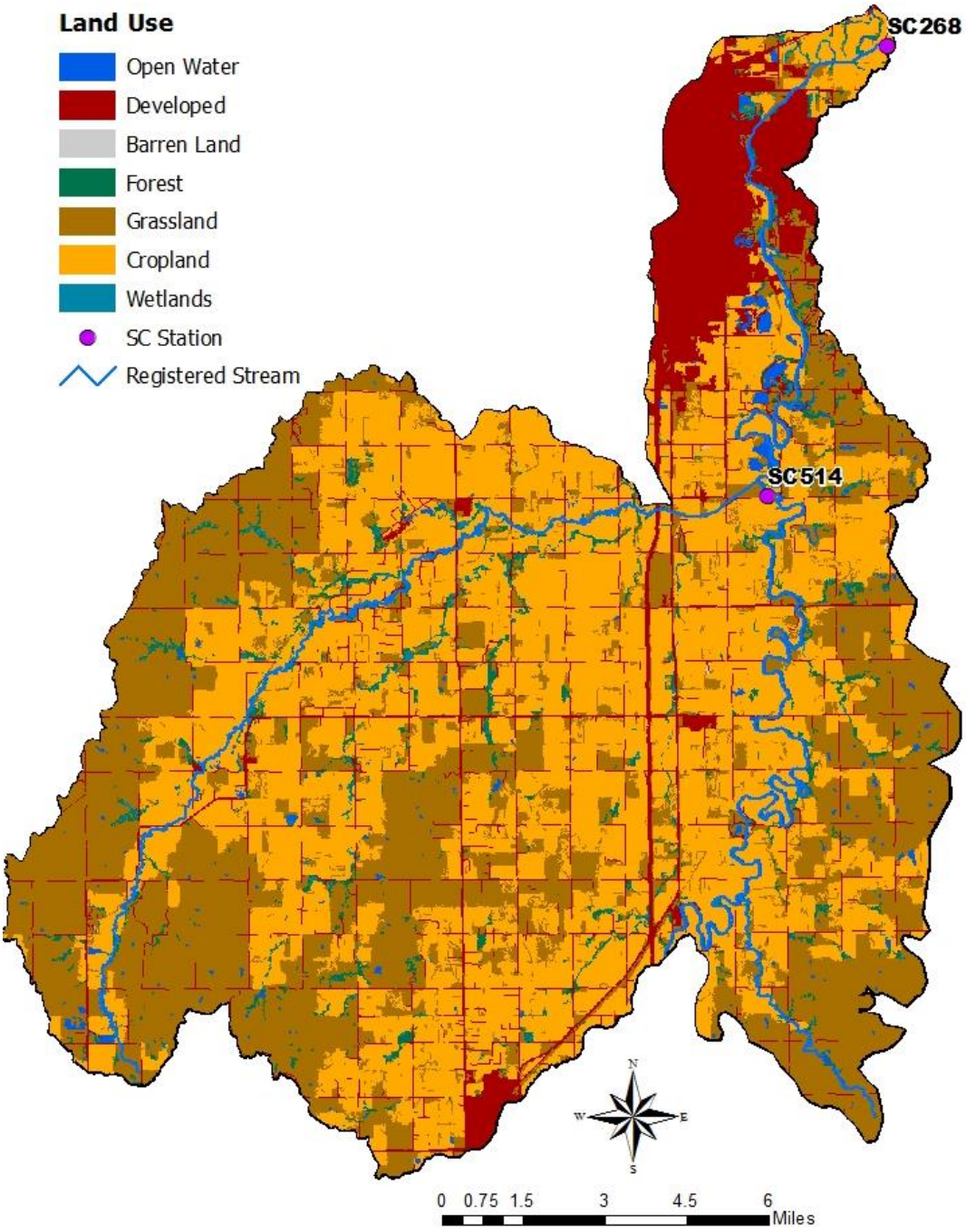
Table 13. Agricultural census results for farms and cropland in Saline County from 2007 and 2012 (U.S. Department of Agriculture, 2012).

Year	Total Farms in Cropland	Total Cropland (acres)
2007	749	431,209
2012	674	364,468
Percent Change	-10	-15

Table 14. Data from the 2011 National Land Cover Database for land cover by percent in the Smoky Hill River near Salina (SC268) Watershed.

Land Cover	Open Water	Developed	Barren	Forest	Grassland	Cultivated Crops	Wetlands
Percent (%)	1	11	0	3	36	48	1

Figure 20. The 2011 National Land Cover Database map for land cover in the Smoky Hill River near Salina (SC268) Watershed.



Population Density

The Smoky Hill River near Salina (SC268) Watershed is located mainly within Saline County and encompasses the City of Assaria, the City of Smolan, and a portion of the City of Salina. According to the 2010 census from the U.S. Census Bureau: Saline County has a population of approximately 55,600; the City of Assaria has a population of 438; the City of Smolan has a population of 215; and the City of Salina has a population of approximately 47,700 (**Table 15**).

From the 2000 to 2010 census, populations within Saline County and the City of Salina have increased by 4%, while the populations in the cities of Assaria and Smolan have decreased by 6 and 1%, respectively.

Table 15. City and county census results from 2000 and 2010 (U.S. Census Bureau, 2010) and population projections for 2040 (Kansas Water Office, 2002).

Location	Population, 2000	Population, 2010	Population Change (%)	Population Projection, 2040
City of Assaria	438	413	-6	426
City of Salina	45,679	47,707	4	58,790
City of Smolan	218	215	-1	246
Saline County	53,597	55,606	4	67,287

On-Site Waste Systems

Saline County, which encompasses the majority of the Smoky Hill River near Salina (SC268) Watershed, is comprised of an 85% urbanized population that is served by public sewer systems (**Table 16**; U.S. Census Bureau, 2010); however, the remaining 15% of the population is classified as rural, and may not be connected to the public sewers. According to the U.S. Environmental Protection Agency's Spreadsheet Tool for Estimating Pollutant Load (STEPL), there are a total of 694 septic systems located in this watershed. Septic systems in the state of Kansas typically have an estimated 10-15% failure rate (Electric Power Research Institute provided by U.S. Environmental Protection Agency, 2017). Failing on-site septic systems have the potential to contribute to nutrient loading in the watershed. However, because of their relatively small flows, failing on-site septic systems are not considered a dominant source of nitrate-n loading within the watershed.

Table 16. Census results by urban and rural population for Saline County from 2010 (U.S. Census Bureau, 2010).

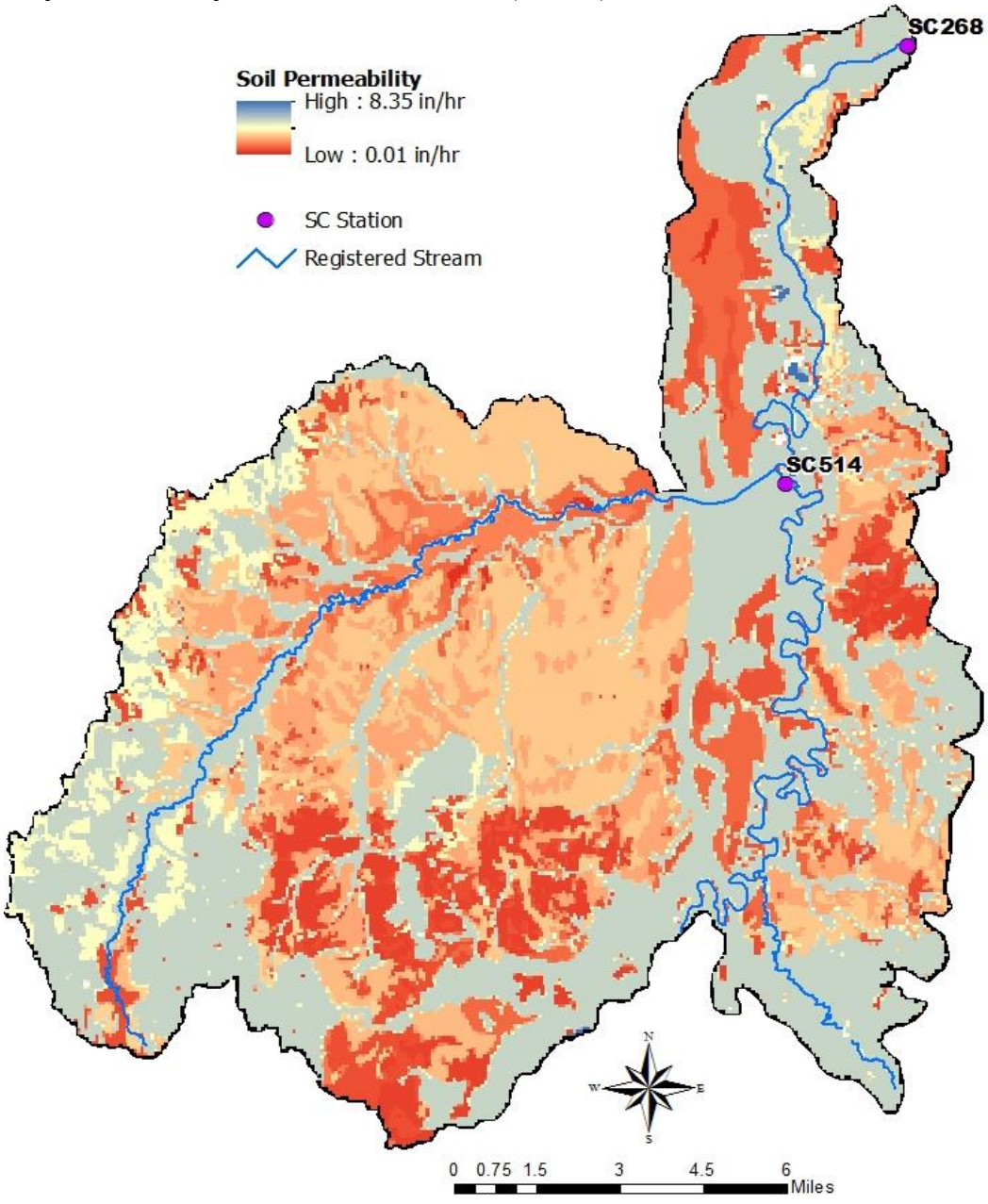
Saline County	Population, 2010	Percent
Urban	47,493	85
Rural	8,113	15

Contributing Runoff

Runoff conditions can occur as a result of either infiltration-excess (precipitation exceeds the infiltration rate of the soil) or saturation-excess (precipitation falls on soils saturated due to an elevated water table), causing overland flow (Juracek, 2000). Overland flow can impact the quality of water entering streams, thereby impacting water-quality loads. Soil permeability categories in Kansas have been defined by the following criteria in inches per hour (in/hr): very high (3.43 in/hr), high (2.86 in/hr), moderate (2.29 in/hr), low (1.71 in/hr), very low (1.14 in/hr), and extremely low (0.57 in/hr). According to the Natural Resources Conservation Service (NRCS) State Soil Geographic Database (STATSGO), the Smoky Hill River near Salina (SC268) Watershed has a soil permeability range of 0.01 to 8.35 in/hr (**Figure 21**). Within the watershed, 37% of the area has a soil permeability less than 1.14 in/hr. Overall, the watershed

has a mean soil permeability of 0.84 in/hr, placing the overall watershed in the very low soil permeability category.

Figure 21. Map of Natural Resources Conservation Service State Soil Geographic Database soil permeability in the Smoky Hill River near Salina (SC268) Watershed.



Background Levels

Organic material, atmospheric deposition, and groundwater upwelling can contribute various forms of nitrogen to streams, which can create ambient levels of nitrate-n due to nitrification and denitrification. Background nitrate-n levels should result in minimal loading to the stream, making a violation of water quality standards through ambient nitrate-n levels unlikely.

4. ALLOCATION OF POLLUTANT REDUCTION RESPONSIBILITY

Load Capacity

This TMDL, or load capacity (LC), is established to meet the existing nitrate-n water quality criterion of 10 mg/L in the Smoky Hill River near Salina (SC268). Once nitrate-n loading in the Smoky Hill River at upstream station Smoky Hill River near Mentor (SC514) is accounted for, incremental loading for the Smoky Hill River TMDL Watershed can be estimated by subtracting the upstream load from downstream loading capacity. The established TMDL emphasizes nitrate-n reductions from point sources, particularly the municipal mechanical WWTP, as they are the primary contributors of nitrate-n in this watershed.

For purposes of comparing current nitrate-n loading conditions in the river to the expected reduction in nitrate-n loading, the current condition was evaluated using the maximum nitrate-n concentration for each flow exceedance range. The highest nitrate-n concentration occurs at 90 percent flow exceedance, which is the only current load condition to exceed the LC of the stream. Sampled nitrate-n concentrations near Salina (SC268) were converted to loads for comparison with the TMDL. Congruent with the current load conditions, only nitrate-n samples from low flow conditions (90-100%) exceed the LC, further supporting the emphasis this TMDL places upon reducing nitrate-n from point sources.

Wasteload Allocations

Point Sources

The total nitrate-n WLA for point sources in the Smoky Hill River near Salina (SC268) Watershed is 642 lbs/day. The nitrate-n WLAs assigned to all permitted facilities are based upon design flows for each facility, where applicable (**Table 17**).

The non-discharging lagoon operated by the Falun Improvement District and industrial quarry Buildex Inc. (Shale Quarry-Marquette) are both assigned a WLA 0 lbs/day. The WLAs for the discharging lagoon systems operated by the City of Assaria and the City of Smolan are calculated with the nitrate-n concentration of 10 mg/L at design flow. Accordingly, the nitrate-n WLA assigned to the City of Assaria is 5 lbs/day, or 1,825 pounds per year (lbs/year); the nitrate-n WLA assigned to the City of Smolan is 2 lbs/day, or 730 lbs/year.

The WLA for the industrial groundwater remediation facility operated by Smolan Pork Site Groundwater Remediation is calculated with the nitrate-n concentration of 5 mg/L at design flow. Accordingly, the nitrate-n WLA assigned to this facility is 4.5 lbs/day, or 1,643 lbs/year.

The WLA for the industrial groundwater remediation facility operated by Matador Cattle Company is calculated with the nitrate-n concentration of 5 mg/L at design flow. Accordingly, the nitrate-n WLA assigned to this facility is 24 lbs/day, or 8,760 lbs/year. The remaining facility within this watershed is the municipal mechanical WWTP operated by the City of Salina. This facility has a design flow of 7.25 MGD and the WLA is calculated with the nitrate-n concentration of 10 mg/L. Accordingly, the nitrate-n WLA load assigned to this facility by this TMDL is 606 lbs/day, or 221,190 lbs/year; however, as the City of Salina is currently designing a new WWTP that will have a decreased design flow, these loads will be subject to a reduction

based upon the undetermined design flow of this new facility. The altered WLA will be less than that currently anticipated and based upon the nitrate-n concentration of 10 mg/L.

Table 17. Nitrate as nitrogen wasteload allocations for permitted facilities in the Smoky Hill River near Salina (SC268) Watershed.

Permitee	Kansas Permit Number	NPDES Permit Number	Facility Type	Design Flow (MGD)	Nitrate as Nitrogen Wasteload Allocation Concentration (mg/L)	Nitrate as Nitrogen Daily Wasteload Allocation (lbs/day)	Nitrate as Nitrogen Annual Wasteload Allocation (lbs/year)
Falun Improvement District	M-SH51-NO01	KSJ000298	Non-discharging Lagoon	0	0	0	0
Buildex Inc. (Shale Quarry-Marquette)	I-SH25-PO01	KS0095524	Industrial quarry – dewatering pit	0	0	0	0
City of Assaria	M-SH02-OO01	KS0082295	Municipal discharging lagoon	0.06	10	5	1,825
City of Smolan	M-SH36-OO01	KS0099317	Municipal discharging lagoon	0.024	10	2	730
Smolan Pork Site Groundwater Remediation	I-SH36-PO01	KS0100404	Industrial groundwater remediation	0.108	5	5	1,825
Matador Cattle Company	I-SH33-PO12	KS0099996	Industrial groundwater remediation	0.576	5	24	8,760
City of Salina	M-SH33-IO01	KS0038474	Municipal mechanical wastewater treatment plant	7.25	10	606	221,190
Nitrate as Nitrogen Total Reserve Wasteload Allocation						**32**	**11,680**
Nitrate as Nitrogen Total Wasteload Allocation						**674**	**246,010**

Reserve Wasteload Allocation

A reserve WLA is calculated at 5% for the entirety of the Smoky Hill River near Salina (SC268) Watershed in order to accommodate future development within the watershed. The nitrate-n WLA is 642 lbs/day, resulting in a reserve WLA of 32 lbs/day.

Municipal Separate Storm Sewer System

Nitrate-n concentrations at high flow conditions are indicative of dilution, and all nitrate-n excursions within this watershed occurred during low flow conditions. As such, current nitrate-n concentrations are indicative of point source loading, rather than stormwater runoff. Therefore,

the MS4 permit within the watershed is not presently assigned a nitrate-n WLA. Permitted MS4 entities will, however, implement SMPs and BMPs in accordance with their permits in order to reduce nutrient loading to the watershed.

Load Allocation

The LA is established to account for nonpoint sources of nitrate-n in the watershed. Nitrate-n concentrations during high flow conditions currently do not exceed the water quality criterion of 10 mg/L. The LA is defined as the area bounded by the TMDL curve and the total WLA. Under these conditions, nonpoint sources of nitrate-n should not exceed the water quality criterion or the loading capacity of the Smoky Hill River.

Defined Margin of Safety

The margin of safety safeguards against the uncertainty in nitrate-n loading in the Smoky Hill River. The margin of safety is explicitly set at 10% of the calculated nitrate-n LC. This allocation compensates for the lack of knowledge regarding the relationship between the allocated loadings and the resulting water quality.

The described TMDL, or LC, is delineated below for the Smoky Hill River near Salina (SC268) Watershed (**Figure 22**; **Table 18**).

Figure 22. Nitrate as nitrogen Total Maximum Daily Load near Salina (SC268) in the Smoky Hill River.

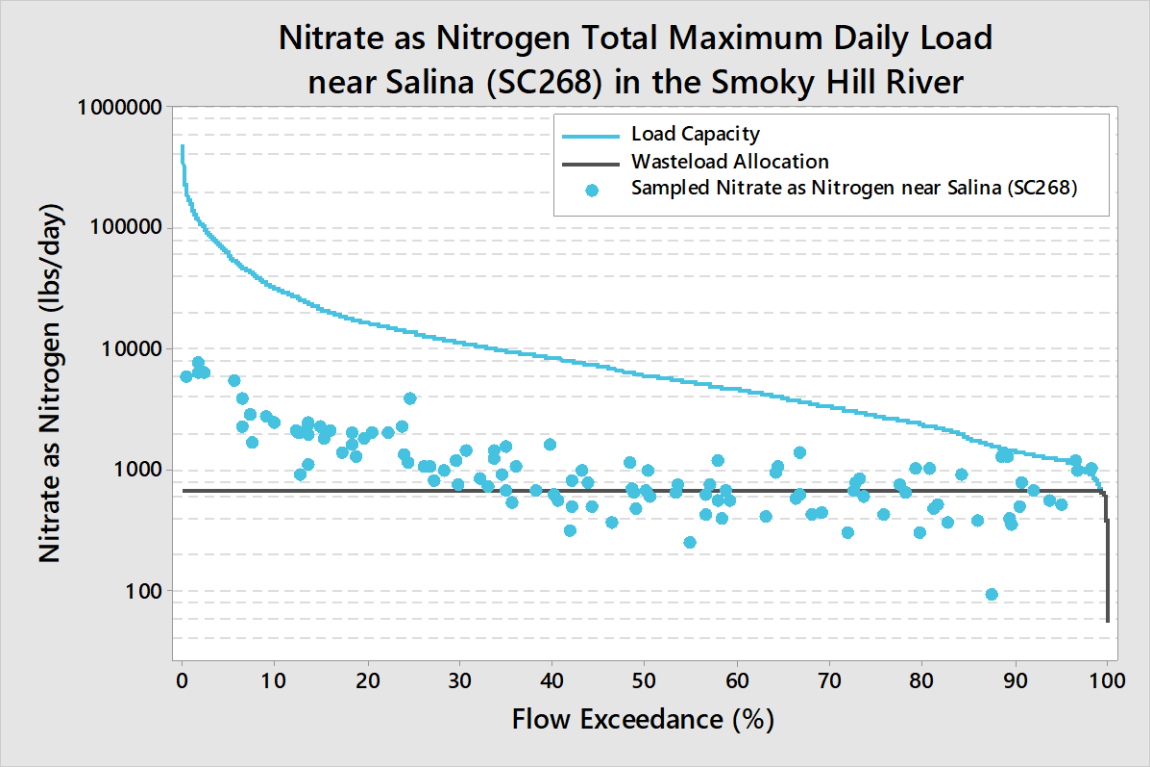


Table 18. Current load conditions (based upon the maximum nitrate-n concentration for each flow exceedance range), total load capacity, and load capacity apportionment near Salina (SC268) in the Smoky Hill River.

Flow Exceedance (%)	Flow at Terminus (CFS)	Maximum Concentration (mg/L)	Current Condition (lbs/day)	Load Capacity (lbs/day)	Wasteload Allocation (lbs/day)	Reserve Wasteload Allocation (lbs/day)	Margin of Safety (lbs/day)	Load Allocation (lbs/day)
90	27	10.8	1,575	1,458	642	32	146	638
75	52	8.4	2,359	2,808	642	32	281	1,853
50	112	3.7	2,238	6,048	642	32	605	4,769
25	251	2.8	3,795	13,554	642	32	1,355	11,525
10	599	1.6	5,175	32,346	642	32	3,235	28,437

Priority HUC12s

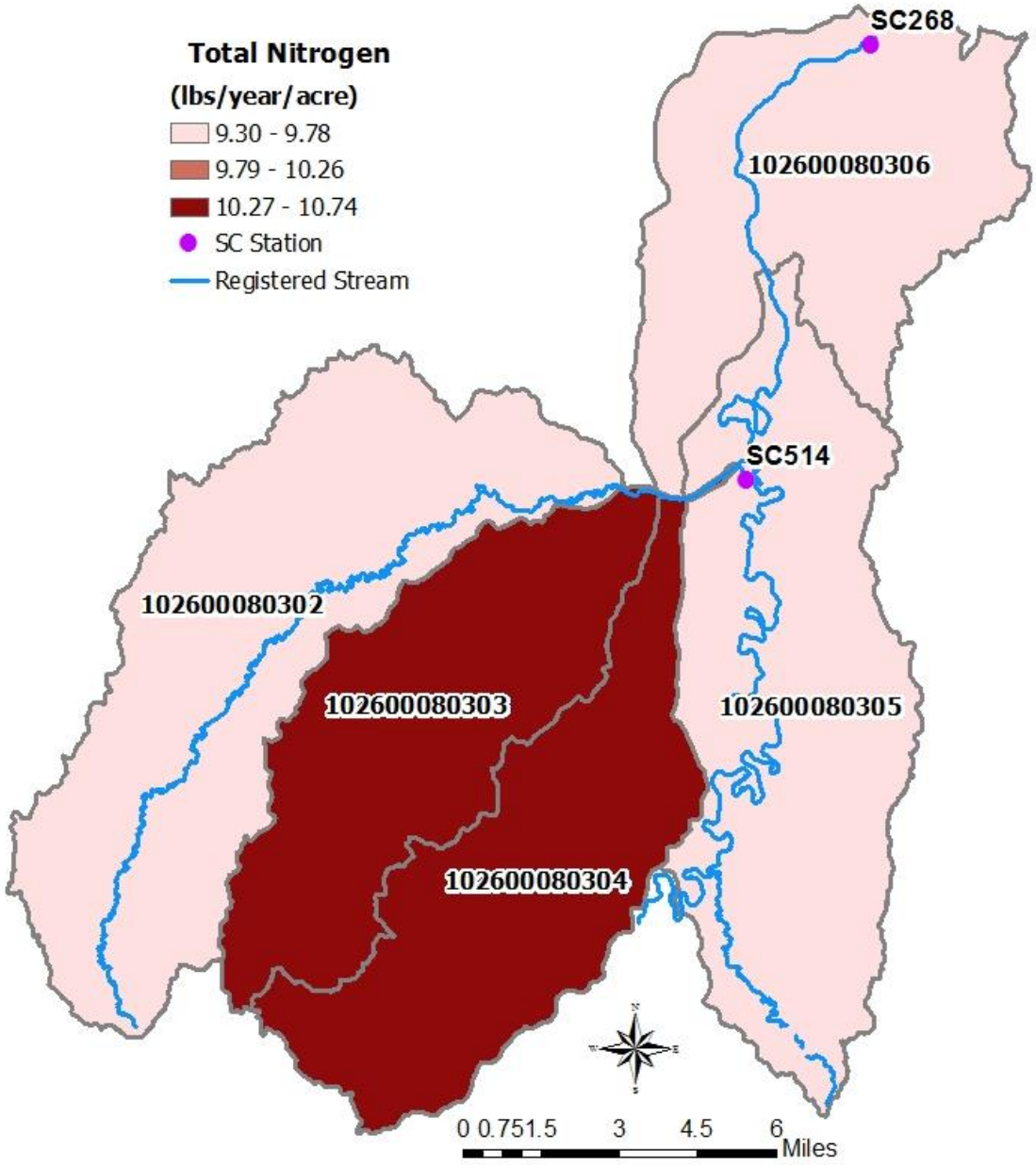
Although this TMDL will initially be driven by implementation of point source treatment improvements, reductions in nonpoint sources will focus on BMP implementation in those HUC12s most impacted by total nitrogen loading (**Table 19**; **Figure 23**). The Smoky Hill River near Salina (SC268) Watershed consists of five HUC12s. According to STEPL, the Smoky Hill River near Salina (SC268) Watershed high priority HUC12s are 102600080303 and 102600080304. Proactive entities may implement BMPs at any time, with an emphasis on priority HUC12s likely yielding the greatest nitrate-n reductions to the Smoky Hill River near Salina (SC268) Watershed.

Table 19. Priority HUC12s by nitrogen load in the Smoky Hill River near Salina (SC268) Watershed according to estimations from the Spreadsheet Tool for Estimating Pollutant Load.

Watershed	Land Area (acres)	Nitrogen (lbs/year)	Total (lbs/year/acre)
102600080302	34,785	323,583	9.30
102600080303	**22,375**	**232,614**	**10.40**
102600080304	**22,397**	**240,192**	**10.72**
102600080305	30,698	291,054	9.48
102600080306	23,124	216,108	9.35

Definitions: **Bold** - Priority HUC12s

Figure 23. Map of priority HUC12s by nitrogen load in the Smoky Hill River near Salina (SC268) Watershed (U.S. Environmental Protection Agency, 2017).



State Water Plan Implementation Priority

Due to the prevalence of high nitrate-n concentrations in the Smoky Hill River downstream of a major municipal mechanical WWTP, this TMDL focuses on reducing nitrate-n in the City of Salina WWTP effluent. Due to the need to reduce the high nutrient loads in the Smoky Hill River, this TMDL will be **High Priority** for implementation.

Nutrient Reduction Framework Priority Ranking

This watershed lies within the Lower Smoky Hill Subbasin (HUC8 10260008), which is among the top sixteen HUC8s targeted for state action to reduce nutrients.

5. IMPLEMENTATION

Desired Implementation Activities

1. Make operational changes in the City of Salina WWTP to reduce the nitrate-n load.
2. Facilitate wastewater reuse for treated municipal wastewater.
3. Renew state and federal permits and inspect permitted facilities for permit compliance.
4. Improve riparian conditions along stream systems by installing grass and/or forest buffer strips along the streams and drainage channels in the watershed.
5. Implement and maintain conservation farming practices—including conservation tilling, contour farming, and no-till farming—in order to reduce runoff and cropland erosion of agricultural areas in the watershed.
6. Perform extensive soil testing to ensure excess nitrogen is not unnecessarily applied.
7. Ensure labeled application rates for chemical fertilizers are followed to reduce runoff.
8. Implement nutrient management plans and ensure that land-applied manure is properly managed to reduce runoff.
9. Ensure proper on-site waste system operations in proximity to main stream and tributary segments.
10. Support implementation efforts of the Upper Lower Smoky Hill River Watershed Restoration and Protection Strategy (WRAPS).

Implementation Program Guidance

NPDES and State Permits – KDHE

a. Continue to monitor effluent from the permitted discharging WWTP, encourage wastewater reuse and irrigation disposal, and ensure compliance and proper operation of WWTP to control nitrate-n in wastewater effluent.
b. Establish permit limits in 2025, with the initial implementation of goals and appropriate schedules of compliance for permits issued prior.
c. Manage the WLA for the watershed to accommodate growth as needed.
d. Implement manure management plans detailing proper land application rates and practices to prevent runoff of applied manure.

Nonpoint Source Pollution Technical Assistance – KDHE

a. Support Section 319 implementation projects for nutrient management through reduction of nitrate-n runoff from agricultural activities.
b. Provide technical assistance on practices to establish vegetative buffer strips.
c. Support implementation efforts of the Upper Lower Smoky Hill River WRAPS, and incorporate long term objectives of this TMDL into their 9-element watershed plan.
d. Provide technical assistance on nutrient management for livestock facilities and practices which minimize impacts of small livestock operations to reduce impacts to stream resources.

Water Resource Cost Share and Nonpoint Source Pollution Control Program – Kansas Department of Agriculture-Division of Conservation (KDA-DOC)

a. Support conservation farming practices—including no-till, terraces, and contours—and/or erosion control structures, including sediment control basins and constructed wetlands.
b. Encourage residue management to reduce nitrogen loss to volatilization or runoff transport from croplands in the watershed.
c. Implement manure management plans.
d. Install livestock waste management systems for manure storage.
e. Repair or replace failing septic systems which are located within 100 feet of the Smoky Hill River or its tributaries.

Riparian Protection Program – KDA-DOC

a. Establish or re-establish natural riparian systems, including vegetative filter strips and streambank vegetation.
b. Develop riparian restoration projects along targeted stream segments, especially those areas with baseflow.
c. Promote wetland construction to reduce runoff and assimilate loadings.
d. Coordinate riparian management within the watershed and develop riparian restoration projects.

Buffer Initiative Program – KDA-DOC

a. Install grass buffer strips near streams.
b. Mitigate removal of riparian lands from Conservation Reserve Program to hold streamside land out of production.

Extension Outreach and Technical Assistance – Kansas State University

a. Educate agricultural producers on sediment, nutrient, and pasture management.
b. Provide technical assistance on buffer strip design and minimizing cropland runoff.
c. Encourage annual soil testing to determine capacity of field to hold nitrogen.
d. Educate residents, landowners, and watershed stakeholders about nonpoint source pollution.
e. Promote and utilize the WRAPS efforts for pollution prevention, runoff control, and resource management.
f. Educate livestock producers on livestock waste management, land applied manure applications, and nutrient management planning.
g. Provide technical assistance on livestock waste management systems and nutrient management planning.

Timeframe for Implementation

Reduction strategies for the City of Salina WWTP (KS0038474) should be evaluated by 2021 with any necessary enhanced treatment initiated by the next permit starting in 2025. Pollutant reduction practices should be installed within the priority subwatersheds after 2019 with follow-up implementation continuing through 2029.

Targeted Participants:
The primary participant for implementation is the City of Salina WWTP (KS0038474). Agricultural operations immediately adjacent to the Smoky Hill River and its tributaries will be encouraged to implement appropriate practices to further reduce nitrogen loads, as well. Watershed coordinators, technical staff of the WRAPS group, conservation district personnel, and county extension agents should coordinate to assess possible nutrient sources adjacent to streams. Implementation activities to address nonpoint sources should focus on those areas with the greatest potential to impact nutrient concentrations adjacent to the river.

Targeted activities to focus attention toward include:

1. Denuded riparian vegetation and poor riparian areas along the stream.
2. Conservation compliance on highly erodible areas.
3. Unbuffered cropland adjacent to the stream.
4. Total row crop acreage and gully locations.
5. No till or residue management on cropland.
6. Sites where drainage runs through or adjacent to livestock areas.
7. Sites where livestock have full access to the stream and it is their primary water supply.

Milestone for 2029
Advancement of necessary and appropriate measures to decrease nitrate-n in effluent from the City of Salina WWTP (KS0038474) should be implemented by the end of 2024. At that time, nitrate-n data from the station near Salina (SC268) in the Smoky Hill River should show indication of declining nitrate-n concentrations relative to the pre-2017 data, particularly during normal and low flow conditions.

Delivery Agents
The primary delivery agents for program participation will be the City of Salina, KDHE, and the Upper Lower Smoky Hill River WRAPS.

Reasonable Assurances
Authorities
The following authorities may be used to direct activities in the watershed to reduce pollution:

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.
2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.
3. K.S.A. 2002 Supp. 82a-2001 identifies the classes of recreation use and defines impairment for streams.
4. K.A.R. 28-16-69 through 71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

5. K.S.A. 2-1915 empowers the State Conservation Commission to develop programs to assist the protection, conservation, and management of soil and water resources in the state, including riparian areas.
6. K.S.A. 75-5657 empowers the State Conservation Commission to provide financial assistance for local project work plans developed to control nonpoint source pollution.
7. K.S.A. 82a-901, et. seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of the state.
8. K.S.A. 82a-951 creates the State Water Plan Fund to finance the implementation of the *Kansas Water Plan*, including selected WRAPS.
9. The *Kansas Water Plan* provides the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

Funding

The State Water Plan annually generates $12-13 million and is the primary funding mechanism for implementing water quality protection and pollution reduction activities in the state through the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watershed and water resources by priority. Typically, the state allocates at least 50% of the fund to programs supporting water quality protection. This watershed and its TMDL are located within a **High Priority** area and should receive support for pollution abatement practices that lower the loading of sediment and nutrients.

Effectiveness

Use of Biological Nutrient Removal technology in WWTPs has been well established to reduce nutrients, including nitrate-n, in wastewater. Agricultural nutrient control has been proven effective through conservation tillage, contour farming, and use of grass waterways and buffer strips. Additionally, the proper implementation of comprehensive livestock waste management plans has proven effective at reducing nutrient runoff associated with livestock facilities.

6. MONITORING

Monitoring will continue at KDHE stations for nitrate-n in the Smoky Hill River near Mentor (SC514) near Salina (SC268). Based on the sampling data, the status of the watershed will be re-evaluated during the 303(d) listing process in 2030.

7. FEEDBACK

Public Notice

An active website is established at http://www.kdheks.gov/tmdl/planning_mgmt.htm to convey information to the public on the general establishment of TMDLs and to provide specific TMDLs by river basin. This TMDL was posted to the Smoky-Saline River Basin on this site on November 30, 2018 for public review.

Public Hearing

A public hearing on this TMDL was held on December 14, 2018 in Salina, Kansas to receive public comments. No public comment was received.

Milestone Evaluation

In 2029, evaluation will be made as to the degree of implementation that occurred within the watershed. Subsequent decisions will be made through consultation with local stakeholders and the WRAPS team regarding implementation of nonpoint source reduction strategies and development of additional implementation strategies for the watershed.

Consideration for 303(d) Delisting

The Smoky Hill River segments covered by this TMDL will be evaluated for delisting under Section 303(d) based on the monitoring data from 2019-2029. Therefore, the decision for delisting will ensue in the preparation for the 2030 Section 303(d) list. Should modifications be made to the applicable water quality criteria during the implementation period, consideration for delisting, desired endpoints of this TMDL, and implementation activities may be adjusted accordingly.

Incorporation into the TMDL Vision Process, Water Quality Management Plan, and the Kansas Water Planning Process

Under the current version of the Kansas TMDL Vision Process, the next anticipated revision of this TMDL will be after 2024. The revision will emphasize implementation of WRAPS activities and further reduction of nutrients in wastewater discharged by NPDES facilities. At that time, incorporation of this TMDL will be made into the WRAPS plan. Recommendations for this TMDL will be considered in the *Kansas Water Plan* implementation decisions under the State Water Planning Process for fiscal years 2019-2029.

Developed: July 2, 2019

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